THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIV. No. 1904.] LONDON, NOVEMBER 7, 1899. [51ST YEAR. PRICE 6d.

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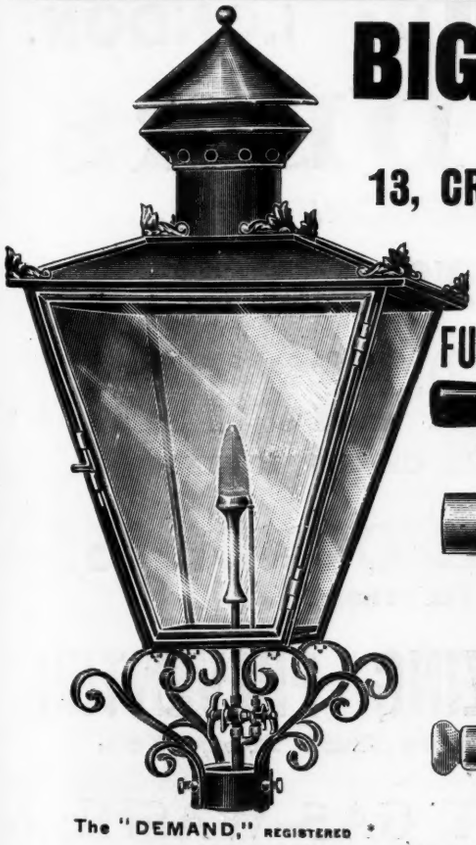
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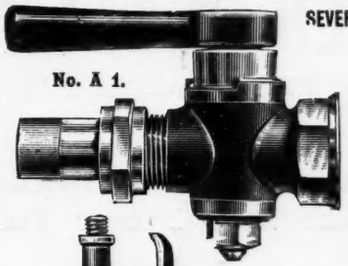
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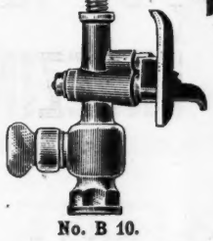
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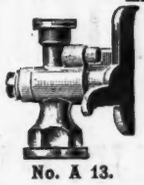
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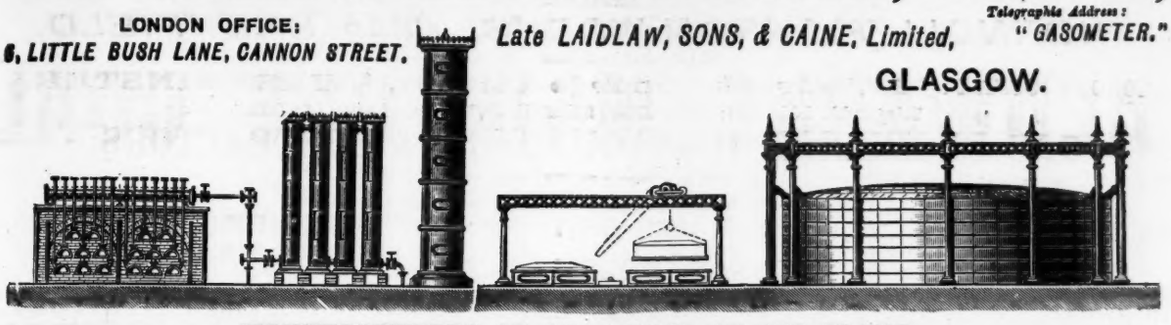

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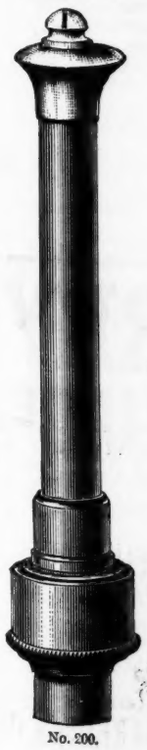

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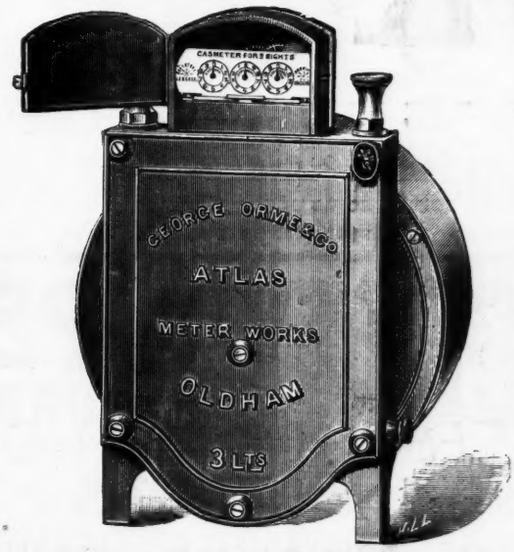

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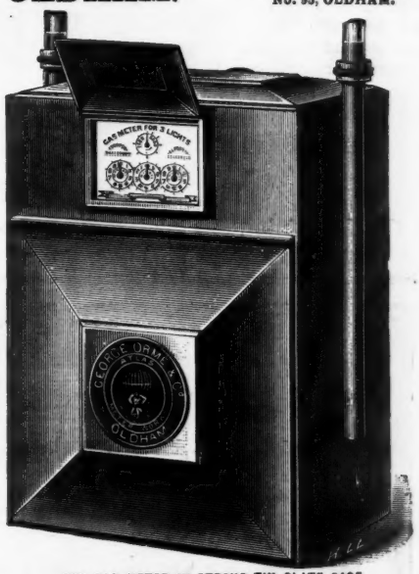

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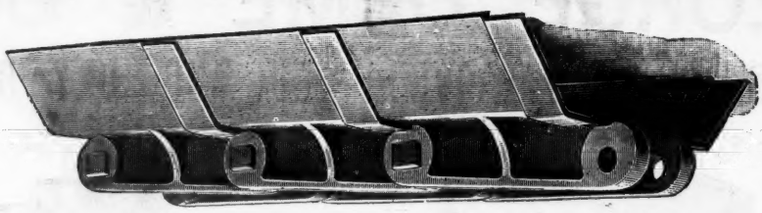

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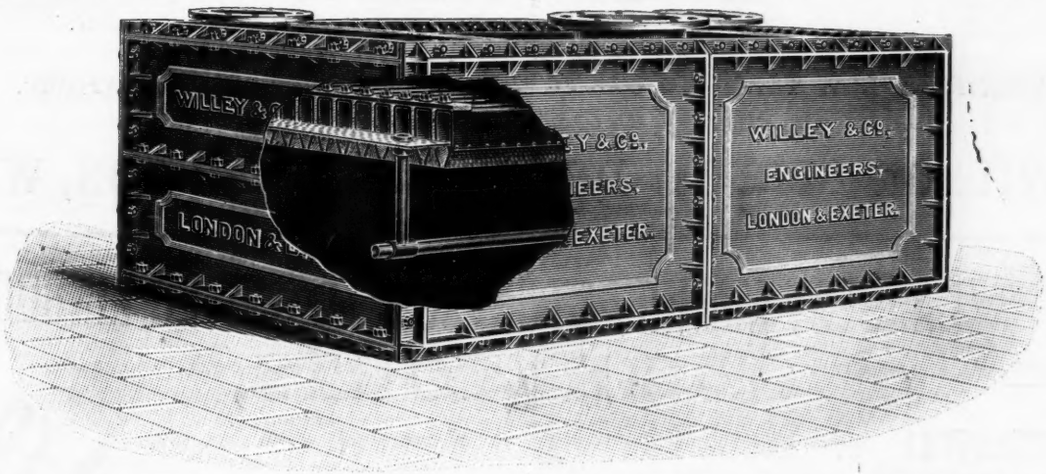

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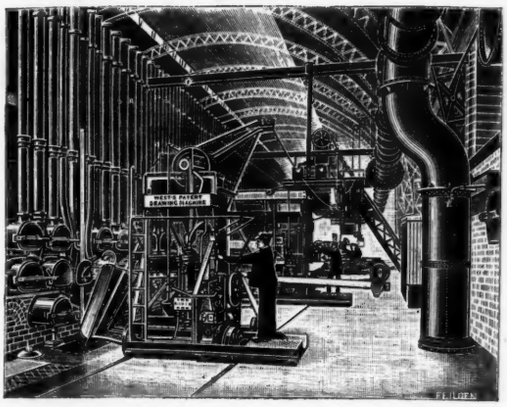

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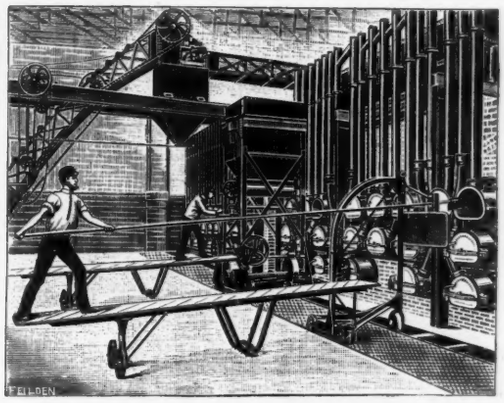

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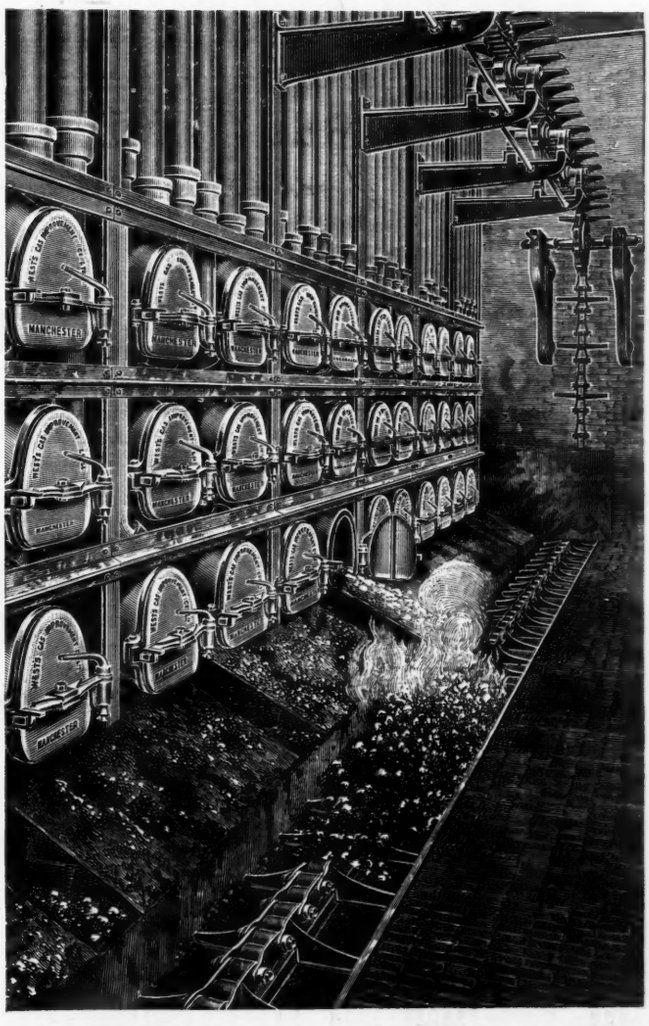

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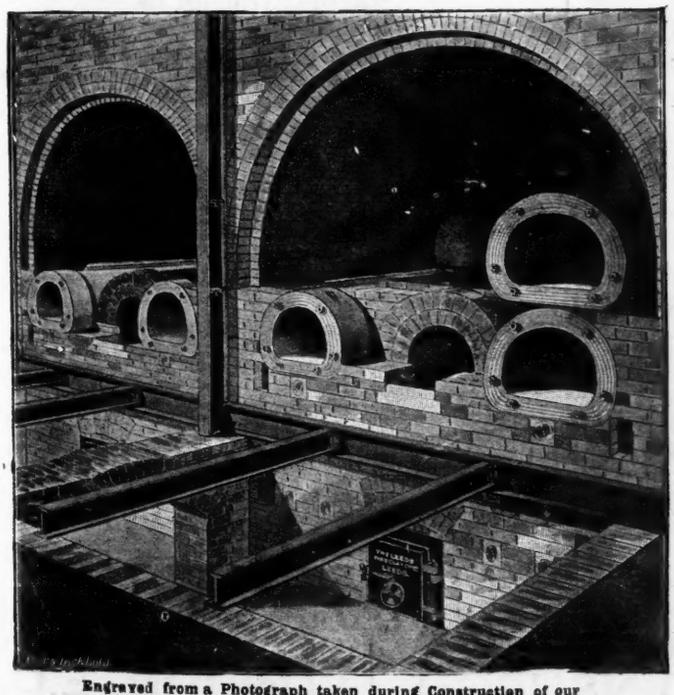

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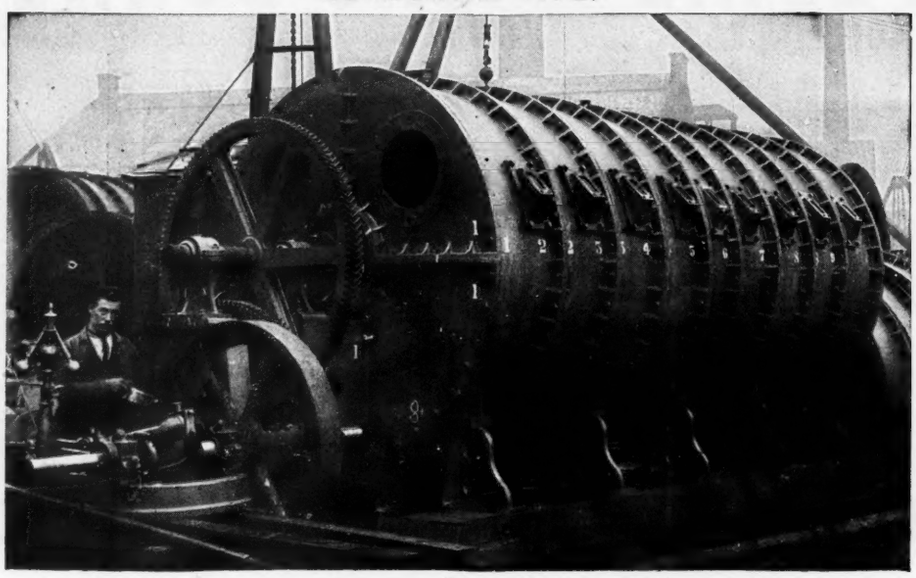

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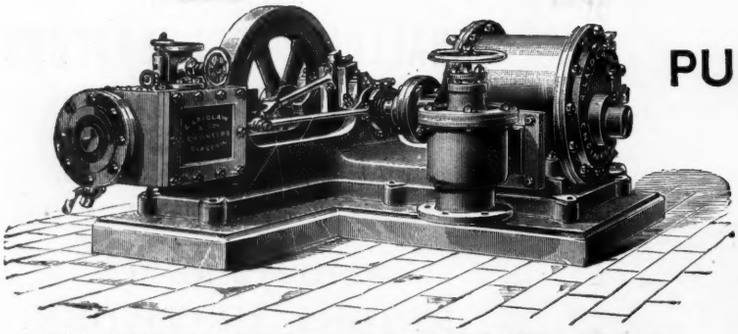

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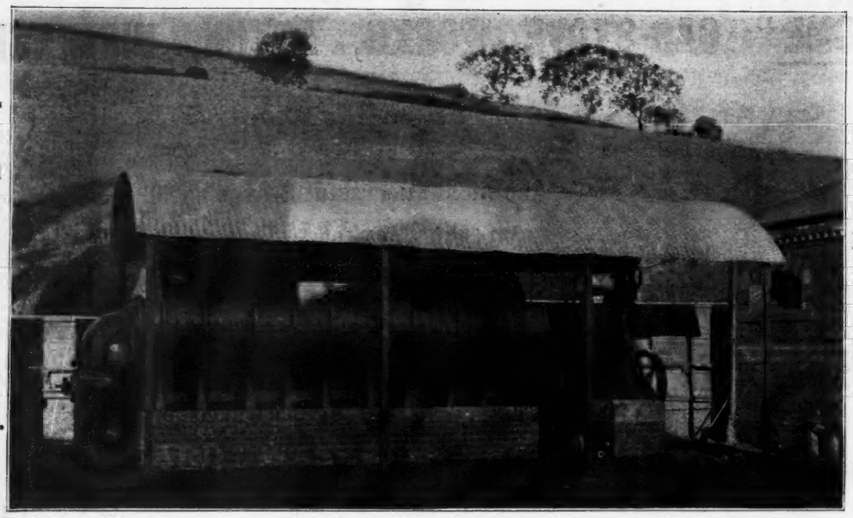

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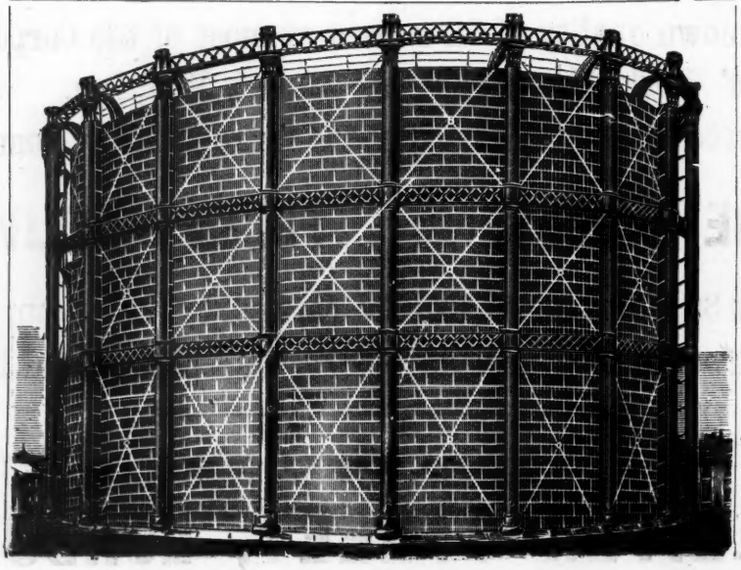

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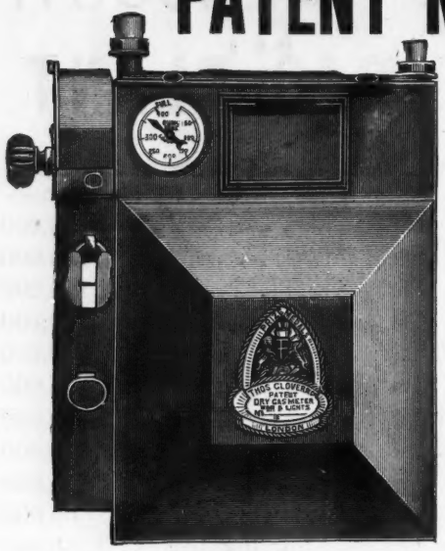

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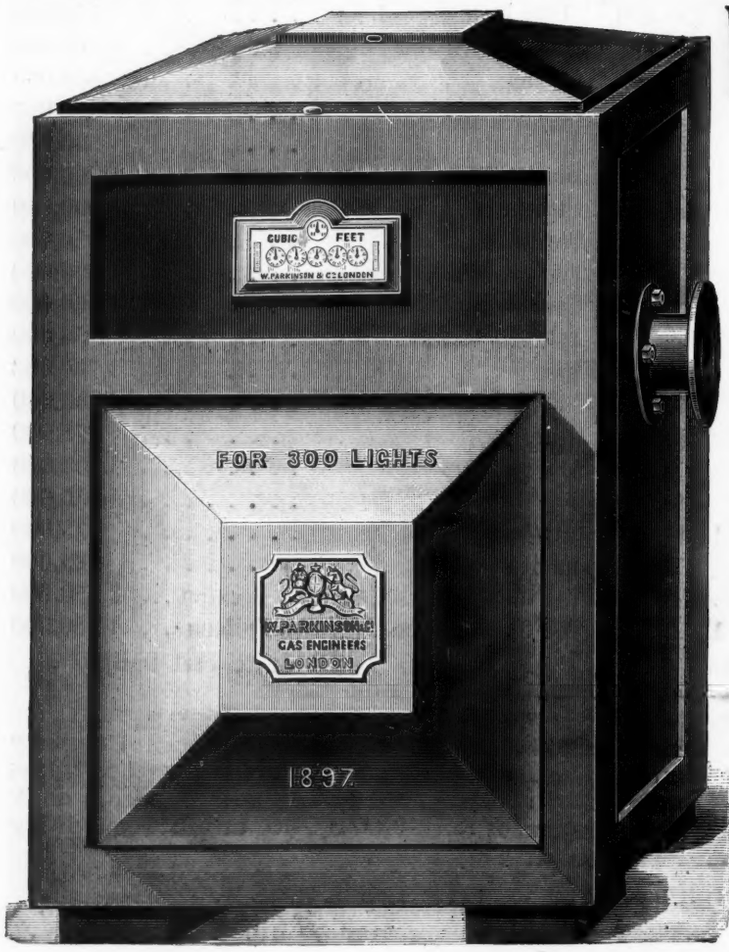

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EDITORIAL NOTES.

Accident at the Rochdale Road, Manchester, Gas-Works—Death of Mr. G. E. Stevenson.

IT was our melancholy duty last week to announce, in a paragraph which had to be prepared while the bulk of the "JOURNAL" was actually in the press, the occurrence of a lamentable accident at the Rochdale Road Gas-Works of the Manchester Corporation, by which Mr. George Ernest Stevenson, the Chief Engineer to the Gas Committee, lost his life, and about a dozen other officers and servants of the Committee were more or less injured. Never has it been the task of the Technical Press to record such a casualty to a person in Mr. Stevenson's position. The sympathy of the entire gas engineering profession will go out to Mr. Stevenson's bereaved family and friends; and natural grief at the loss of so sterling and amiable a man will be chastened by the reflection that death, by taking him from the post of duty, has conferred on its victim a distinction not otherwise attainable. The manner of Mr. Stevenson's departure from the scene of his common-place labours and ordinary responsibilities, has in it the recompense of immortality, such as martyrs share.

Natural feeling being thus expressed, however, the next emotion suggested by the terrible catastrophe is curiosity as to how it happened. The inevitable inquest was opened on Thursday, and adjourned. With a directness which was almost confusing, the Gas Committee brought into the Coroner's Court a man, described as a stoker, who admitted having taken away forcibly from the place where the gas-main had been cut, a force-pump which was actually connected with the air-bag in use for stopping the main. This was "putting the cart before "the horse;" but the short story of the affair appears to be as follows: A live 24-inch gas-main, described as a trunk main in connection with the district, was being stopped off at a point in the works which had been an old meter and governor house. Near by was a lighted clock tower; and there was a boiler-house not far away. The main had been plugged with a bag in the usual way. The bag was blown out by means of a service force-pump, which still remained connected with it by the flexible tube. Thus matters stood, while the open end of the main was being bricked up under the supervision of Mr. Stevenson and the Station Manager. The man already mentioned is reported to have come upon the scene, and pulled away the force-pump, notwithstanding the remonstrance of another workman who was watching the bag. There seems even to have been a scuffle; and the pump was roughly torn away, with the tube hanging to it. The air-bag in the main instantly collapsed, although one of the men made a desperate attempt to blow it out with his mouth. Gas rushed out at the end of the pipe, and caught fire somehow—perhaps from the pilot-light inside the clock overhead. It does not require much graphic writing to tell what would be likely to happen in the case of a 24-inch main pouring out gas under a pressure of 20-10ths. Many questions are suggested by this bare statement of the reported circumstances; but this is not the place, nor the time, to enumerate or to discuss them. After the proceedings at the adjourned inquest, the facts will probably be clearer; and there will be no harm then in examining them for their bearing upon the ordinary aspects of gas-works routine.

The Seamy Side of Municipalism at Blackpool.

THE action of the Blackpool Town Council in deliberately returning a recommendation of their own Gas Committee for a reduction in the price of gas from 2s. 4d. to 2s. 2d. per 1000 cubic feet in the case of ordinary meter consumers, and to give the coin-meter consumers 33 cubic feet of gas instead of 25 cubic feet for a penny, appears to call for some notice. There is an unsavoury flavour about the incident; and it is very desirable that the utmost publicity should be given to all these actualities of Municipalism, for the instruction of a community only too prone to take our Local Authorities at their own high valuation. In the case of Blackpool, the issue of cheap gas was confused by several conflicting considerations, some of which may be distinguished in the remarks of the speakers in the Town Council debate which we report in another column. Others must be sought for in the background. Very often, in similar cases, the unspoken arguments are more potent than those which find utterance. It may be taken as certain

that many members of the Blackpool Gas Committee—and in particular their Engineer—are desirous of selling gas at as cheap a rate as possible all round. During the period of agitation that preceded the Municipal elections, the cause of cheap gas was made a platform cry. Some of the new candidates for election to the Corporation endeavoured to get in on this ticket. We do not know whether the seats thus challenged were occupied by members of the Gas Committee; but at any rate, in the middle of the contest out came this recommendation of the old Committee, which cut the ground from under the feet of the opposing candidates. Let us hope the recommendation was honestly meant; it appeared at a very convenient season, for electioneering purposes. Here let us stop for an instant to suggest that the eve of the Municipal elections is not quite the proper time for announcements relating to the finances of the Authority. The close of the Municipal year, in March, is a far more suitable opportunity for adjusting rates, charges, salaries, and all this most important kind of Corporation business. If, as is plausibly suggested, the promulgation of the Gas Committee's resolution had an electioneering object, it was very cheaply attained; for the Council quashed the proposal. This also might have been arranged, or foreseen. It is commonly supposed that Committees of public bodies do not often make important recommendations without adequate preparation. As the record stands, the recommendation in this instance looks like an electioneering "dodge;" and if the impeachment is just, it is not a very creditable performance. So much for the politics of the case.

With regard to the merit of the proposed reductions, opinion may be divided. Gas at 2s. 4d. per 1000 cubic feet to ordinary consumers is not dear, judged by the charges for the same commodity in neighbouring towns; but it is not as cheap as the Committee could sell it, if they had not to subsidize the rates. On the other hand, if Blackpool rates are only 4s. 9d. in the pound, as the Mayor stated in the discussion, this is decidedly low as compared with other places. It therefore comes to this: If the interests of the Blackpool ratepayers and gas consumers were "equal and "opposite," as Euclid says, it would be a matter of indifference whether they paid the necessary expenses of local government on the rate demand note, or by the gas bill. But the coin meter now comes in to disturb this comfortable assumption—which always prevails, be it noticed, where the indirect taxation of gas consumers is practised. At Blackpool, the coin-meter consumer pays in advance 3s. 4d. per 1000 cubic feet for his gas; while the aristocrats, who pay quarterly, get the very same article for 2s. 4d. per 1000 cubic feet. In London and other places where the gas supply is in the hands of grasping monopolist Companies, who carry on the business for greed of gain, the surcharge to the coin-meter consumers is about 9d. or 10d. per 1000 cubic feet, which covers the suspense account for fitting up the premises with pipes and attachments, including a cooking-stove. If Blackpool is like most Lancashire towns, the gas-pipes are put into new cottage buildings as a matter of course; so the surcharge of the Gas Committee for coin-meter supplies is not required to defray this expense. But this is how the splendid Municipalism of Blackpool works out: The cottagers pay weekly rent, which includes all rates. They pay the pennies into the coin meters themselves. Their public-spirited pastors and masters in the Corporation—none of whom, possibly, owns cottage property—are keen on keeping down the rates. The justice of the coin-meter surcharge is a poor man's question—handy to play with at election times, perhaps, but not a matter of practical local politics afterwards. Give the poor man 33 cubic feet of gas for a penny, and so jeopardize the sacred rate fund? Not Blackpool! It is the coin-meter consumers' landlord who is the ratepayer; and he is the gentleman to be considered. Better keep the rates down, and the pennyworths of gas up! Of course, we may be writing under a complete misapprehension, and doing the Blackpool Corporation an injustice. If so, we will accept correction. As the record stands, however, the incident certainly has not a pleasant flavour.

Collapse of the Strike in South Wales.

THE strike of the colliery enginemen in South Wales, which threatened serious trouble, has been very short-lived. The men's notices to cease work expired on Wednesday last, and would, if they had been fully acted upon and effective, have stopped work in the case of about 20,000 miners. At the end of the week, only some 2000 men were idle; and as we write news reaches London that all the collieries have resumed work. To a large extent the strike was altogether averted; the men coming to terms with the employers literally at the twelfth hour. Meetings held late on Tuesday, in many cases, resulted in the men continuing at work. At several collieries the masters made further substantial concessions, which proved acceptable to the men; at some the notices were suspended for a week, with the result that a settlement has been since effected; while at others the men accepted the terms offered by the owners (and rejected by the men's leaders) on the 25th ult. In addition to these settlements, a stoppage was avoided at some pits by the owners providing substitutes for the enginemen. Altogether, it is estimated that only something over 5000 men were idle on the first day of the strike—including about 3500 colliers employed by the Dowlais Company, who resumed work the next day.

A very potent factor in the situation proved to be the refusal of the Miners' Federation to support the movement, and upon which we remarked last week. The Federation professed to be huffed because the Enginemen's Association had not sought their assistance or taken them into their confidence; and they advised their members that any stoppage of work upon their part, should the owners provide acceptable substitutes to keep the engines running, would be illegal, as no notices had been tendered by them. The attitude of the Federation was unexceptionable; but it is to be noted that, since the enginemen originally gave in notices expiring on the 1st ult., if the Federation had wished to support them they had every opportunity of tendering notices themselves. The inference to be drawn is, we think, that, with wages at their present figure, miners are not anxious to stop work; and threats to strike must be considered to be, in most cases at the present time, moves in the game of bluff. The fact is that neither owners nor men wish to stand idle while trade is so brisk and prices are so high.

This is fully illustrated by the history of the Western District dispute during the past week. In this case, the men working the Swansea collieries began some months ago to agitate for higher wages. The owners in self-defence joined the Monmouthshire and South Wales Owners' Association. They then called upon their men to sign the contract-book, bringing them under the sliding-scale. The men declined, unless given an advance in the standard rate of wages. The masters—not the men—then gave notices to terminate agreements (in order to enforce the signing of the book), the expiration of which was postponed from Aug. 31 until last Tuesday; and intervening negotiations proved abortive. On Monday, the 30th ult., however, the Owners' Association suspended the rule which requires all workmen in the associated collieries to affix their signatures to the contract-book; and the Western collieries thereupon withdrew their notices. In other words, they are not disposed to fight it out just at present. The onus of carrying on the dispute was thus thrown on the men. They were legally entitled to refuse to accept the withdrawal of the notices and to stop work last Wednesday. This they did not do, but merely contented themselves—and that only in some few instances—with handing in notices to expire at the end of this month. These notices may, however, be looked upon rather as a lever to use in the negotiations which will, in all likelihood, be now re-opened, than as indicating a desire to stop work. No considerable stoppage of the Welsh collieries is then, we think, probable in the near future; but the sources of trouble are only driven under by the pressure of good times. When that good time departs, and the coal buyer is looking for a little relief, the Miners' Federation will be heard from again.

Why is Incandescent Gas Lighting Popular?

IT is a curious inquiry, with regard to the prospects of any new article offered in the market, whether the public will take to it or not. As a rule, only actual trial will show on which side the balance falls, in obedience to some overpowering influence of economy, convenience, safety, or the opposite. The most carefully reasoned-out expectations may be disappointed. Not long ago, we had occasion to remark upon the testimony offered by an old popular science magazine to the satisfaction given by the flint-and-steel method of obtaining a light. On the very eve of the

invention of the lucifer match, it was seriously remarked by competent authority that the incontestable cheapness of the old tinder-box arrangement would always keep it in favour. Our contemporary the "Ironmonger" has lately been exercised over the same old question, which is of such immense economic importance, of whether the private householder thinks more about trouble than about strict economy in connection, say, with appliances for artificial lighting. We are open to confess that, in company with most experienced gas engineers, we were deceived as to the prospects of the incandescent gas-light and the incandescent electric lamp. With regard to the latter, we thought the expense would choke the public off; while the former appeared to require so much attention that nobody who bore in mind how shamefully the public neglected and misused their gas-burners entertained much hope for it. Experience has proved that both generalizations were mistaken. People took largely to electric lighting, because they liked it. The expense did not stand in the way. To a rich man, or an enterprising trader, a doubled or tripled light bill was a bagatelle compared with the grateful sense of feeling himself "in the movement," and strictly "up to "date" with all his arrangements. And because no man likes to admit that he is extravagant, or a soulless follower of the fashion, the patron of electricity pointed to the saving in whitewashing, in doctor's bills, in matches even, as justifying his outlay for the light of his fancy. We can always find some plausible reason for following our inclinations. Quite other, but equally powerful, attractions helped the incandescent gas-burner on its way. It was so undeniably brilliant, to begin with. There was no electric light that it did not put in the shade. People, if healthily constituted, do like a good light to work or play by. Time was when they had to be content with a single candle in a room; but they always had two if they could afford it. Readers of old novels cannot fail to recall the authors' ecstatic mention of "glittering lights" among the peculiar glories of high life in those times. Now a gin palace is as brilliantly lit as a baronial hall. The future is with the most brilliant artificial light, whatever its cost—provided always that it is reliable, and does not give too much trouble. If it is in need of care, it is essential that the care should be well repaid. People will grow mortally tired of a light, like acetylene, which gives a good deal of trouble, and then may not prove satisfactory after all. Where the public are giving up electricity, it is not so much the expense as the unreliability and inefficiency of the lighting that has disappointed them. What people appear to like most about the incandescent gas-light—when they like it at all—is that it does so amply reward, in light and saving of cash, the little trouble that it entails. This effect is perhaps not wonderful, now we have seen it; but it was scarcely to have been expected.

The Sapiency of Popular "Science."

It is commonly supposed to be the duty of the newspapers and the periodical Press generally to "spread the light." In some instances, unfortunately, the light happens to be darkness; and then how dense is that darkness! There are a number of periodicals circulating through the country which appear to witness to the existence in the community of a strong desire to supplement the defects of early schooling by the reading of scraps of miscellaneous information. These journals are not amusing. It is difficult for a person of average culture, who should pick up one of this class of publications during a moment's idling at a newspaper stall, to understand why people will pay their pennies for these journalistic rag-bags. Sometimes the morsels served up in this way are not merely inane; they are occasionally distinctly foolish. We last week came across a specimen, which shall be nameless, which appealed for casual pennies by offering to tell the public "how to meet the rapacity of "our gas companies." It was a precious piece of counsel. Readers were told that they are regularly swindled in the matter of gas bills, and that they should "act accordingly." This remedial action is to take the notable shape of covering the meter and the supply-pipe where visible with a wet flannel jacket, in order to "shrink the gas," and so "save many "and many a cubic foot being totted up by the mendacious "meter." It is further asserted that the Company's meter inspectors "dare not object to this device." Truly scientific and ingenious as this experiment is, however, the editor of the periodical would not commend it. Perhaps he thought the meter would be clever enough to take its jacket off, if it wanted to work lustily. He very sagely appended to the paragraph a note stating that "the true plan is for the "aggrieved customer to connect an accurate measuring "instrument to the outlet of the fraudulent meter. The "character of the latter will then become apparent, and "legal steps may be taken." Of course, every gas consumer has "an accurate measuring instrument" suitable for this purpose at his command, if not in his pocket; and it is so easy for the householder to connect anything "to "the outlet of the fraudulent meter"! This is the kind of legal advice which is sold by the pennyworth. In another place, the same publication recommends an acetylene gas-generator and accessories for household use which "may "be entrusted to the care of an ordinary domestic servant." On the whole, the most mendacious gas-meter that ever needed a wet jacket to check its ardour would probably come cheaper in the long run than a portable acetylene generator in the hands of the maid-of-all-work.

The Fussy London County Council.

The London County Council have been "at it again," with their petroleum lamp and oil criticism. They can no more let the oil alone than they can leave the Water Companies to do their work in peace. The latest performance is a circular containing suggestions for securing safety in the use of lamps. The first thing recommended is that oil with a flash-point of less than 100° Fahr. should never be burnt. This is the same old story, with a difference. Some time ago, the Council themselves adopted a resolution that all burning oil purchased for Council purposes should have a flash-point of at least 105° Fahr. Why not stick to this? Besides, how is the public to know what is the flash-point of the oil that is sold over the retailer's counter or brought round in the cart? Perhaps, when the Council have satisfactorily disposed of the portable photometer question in connection with gas testing, they will organize a system of peripatetic lamp-oil examination. The circular goes on to offer some unexceptionable advice on the choice of lamps and their management. Thus we read that, "in managing a lamp, care should be "taken that the reservoir is kept thoroughly clean, that "all oil is wiped off, and all charred wick and dirt carefully "removed before lighting." This is very helpful. But one misses the usual finish to the announcements of Local Authorities, stating the amount of the fine that may be imposed for any breach of the regulations. In one particular, the Council's advice seems to be a little wire-drawn. It is remarked that "in extinguishing lamps "which have no extinguishing apparatus, the wick should "be turned down until there is only a small flickering "flame; and a flat piece of metal should then be placed "on the top of the chimney, so as to entirely close it." A caution should have been appended to this prescription, warning the public against the use of the handy, but heavy, flat iron for the purpose. Of course, suitable pieces of metal will be distributed by County Council inspectors, and provided out of the rates. The solicitude our masters at Spring Gardens display for the public safety, in matters which are not yet the subject of legislation by a heedless Imperial Parliament, is most touching. Could not the County Council help the householder to the choice and management of an even more important article of furniture than his oil-lamp—to wit, his wife? The resources of local government need not halt at the dissemination of good advice about petroleum.

Gas Affairs in Brussels.—We learn from an esteemed correspondent in Brussels that there has lately been a considerable increase in the consumption of gas in the city. For the third quarter of the year, it was 8·32 per cent. more than in the corresponding period of 1898; while for September it was as much as 11·12 per cent. Works now in progress have had to be expedited, as it is found that certain extensions it had been arranged to carry out next year must be put in hand at once, and those projected for 1901 started in 1900. The Municipal Council are to be asked for a credit of a million francs for the purpose. Our correspondent also states that in January next there will be an exhibition of gas appliances under the auspices of the principal gas undertakings of Belgium; while the Belgian Association of Gas Managers purpose holding, possibly early in the year, what promises to be a highly interesting exhibition of both lighting and heating apparatus—considerable improvement having been effected of late in both classes. During the period that the exhibition remains open conferences on various gas subjects will be held.

WATER AND SANITARY AFFAIRS.

THE London County Council, at their meeting last Tuesday, disposed of one only of the two reports relating to the Metropolitan Water Supply which stood upon the *agenda*. It had reference to the examination of water, with the present arrangements for which the Water Committee are greatly dissatisfied. Though Sir William Crookes and Professor Dewar, testing on behalf of the Companies, may report that the water supplied to London is highly satisfactory, the testimony of these eminent Chemists does not carry much weight with it at Spring Gardens. Possibly it is thought that, somehow or other, they contrive to make out a good case for their clients. At all events, the results arrived at by them do not accord with those obtained by the Council's own Chemist (Dr. Frank Clowes). Even Dr. Percy Frankland, testing for the Local Government Board, and reporting upon the "excellent chemical quality" of the filtered Thames water supplied by the river Companies, does not seem to inspire confidence, as his conclusions on the matter of organic carbon do not agree with those arrived at by the Companies' Chemists or in the County Council's laboratory; and the Committee consider that these discrepancies arise from the method adopted in taking the samples of water. Sir William Crookes and his colleague draw theirs from the clear-water wells at the Companies' filter-beds, believing this to be the most direct test of efficient microbic purification by any process of filtration; Dr. Clowes draws his daily from the mains all over London, considering that the consumers are more concerned with the quality of the water therein and at their taps than in the filter-wells. The Council's Chemist has found, as the result of his examination of 208 samples of water taken in this way, that in 35 per cent. of them Dr. Koch's standard of 100 microbes per cubic centimetre was exceeded. Possibly; but then we are told by the Companies' Chemists that this will occur with any supply —whether derived from the Thames, from chalk wells, or from Wales. They assure us that there is no known mode of avoiding bacterial increase after the water passes into the mains and pipes of a great city like London; and it should be consoling to the consumers to learn, on this high authority, that the additional microbes so generated are known by experience to be "perfectly harmless." Water of the quality of that which was distributed to London in September has never been known to cause water-borne disease. Yet it is not satisfactory to the Water Committee of the Council; and they recommended that body to sanction the continuance of the Chemist's examinations for another period of three months from the 1st prox., at a cost of £37 a week; and to ask the Local Government Board whether they will extend their investigations to a daily test of the water. The Council adopted the recommendation; and by so doing they sanctioned what we regard—and very probably many will agree with us—as a perfectly needless expenditure of the ratepayers' money. The consideration of the other report on the *agenda* last Tuesday—that relating to the proposed legislation on the water question next session—had to be deferred for a week, under the Standing Orders. Without waiting for the report of the Royal Commission, the Council mean to push on with their Bills, the time for giving notice of which is close at hand. The Finance Committee have made a special report on this matter, and it will come before the Council to-day.

In the interesting lecture delivered by Lord Robert Cecil, in the Inner Temple Hall, last Wednesday, to the Solicitors' Managing Clerks' Association, a full abstract of which appears in another part of the "JOURNAL," his Lordship was not able to do more than lay before his large audience a number of facts in connection with the law relating to underground water with which they were probably unacquainted, and which will doubtless be useful to them in their professional work. The subject is admittedly a difficult one; but, in the course of an hour's talk, it was dealt with by the lecturer with a clearness and facility of expression which enabled his auditory to follow him easily. He cited and commented upon the decisions of the Courts from the earliest recorded case bearing upon the right to underground water—that of *Prickman v. Tripp*, in 1693—down to the comparatively recent cases of *Acton v. Blundell* in 1843, and *Chasemore v. Richards* in 1857; bringing out the special point in each. He characterized the former of the two last-named actions as the source of the modern legal doctrine on the subject of underground water—that an owner of land has no right of action against a neighbour who, in carrying on mining operations on his own property, drains the water from wells sunk on that of the adjoining landowner. In the later case of *Chasemore v. Richards*, it was held that the principles which regulate the rights of owners of land in respect of water flowing in "known" and "defined" channels, do not apply to underground water which merely percolates through the strata. The lecturer considered the effect of these decisions upon later cases, and showed how, in that of *Black v. Ballymena Commissioners*, in 1886, the former word was held to mean "known by reasonable in-" ference from existing and observed facts;" and the latter, a contracted and bounded channel, though the course of the stream might be undefined by human knowledge.

An interesting section of the lecture was that in which his Lordship discussed the question as to how far the law relating to underground water applies to other liquids; the conclusion being arrived at that there can be "no rights " of ownership over any natural fluid product of the earth, " outside the limits of the land in which it is found, until " it has been appropriated by some person or other." He expressed a doubt as to whether the fact of pitch or petroleum being a mineral matter is a governing distinction between it and water. In his concluding remarks, the lecturer referred to the growing tendency of Local Authorities to obtain possession of distant watersheds, and convey the water therefrom to supply their communities. Naturally, as he pointed out, the parties affected have complained loudly thereat, and no doubt have been very much inclined to regard the law which allows it in the same light as did the parochial official of modern fiction. But then comes the question whether the few in the country should not be sacrificed to benefit the many in the towns. There is no property in underground water; and cases of hardship doubtless arise which seem to call for some alteration of the law. But whether any such alteration should be made, and how it is to be effected, is, as the lecturer remarked, "another story."

Although some of the audience last Wednesday may not have been able to grasp and retain all the various points brought before them, the lecturer nevertheless deserved the hearty thanks accorded to him for the trouble he had taken in bringing together the important cases bearing upon the subject which have engaged the attention of the Courts in this country and in America, and placing the fruits of his labours at the service of gentlemen holding responsible positions in connection with another branch of his profession. But, as Lord Justice Romer, who presided, remarked in introducing him, Lord Robert Cecil is always ready to uphold the traditions of his family by doing whatever he can for the benefit of his fellow-creatures; and we are pleased to have been able to notice at the length we have done the special instance of this readiness on his Lordship's part which called forth these appreciative remarks.

Reduction in the Price of Gas by The Gaslight and Coke Company.—The Secretary and General Manager of the Gaslight and Coke Company (Mr. J. W. Field) has intimated to all the Vestries and District Boards north of the Thames that on and after the 1st of January next the price of gas to private consumers will be reduced 1d. per 1000 cubic feet.

The Gas Supply of Vienna.—The concession of the Imperial Continental Gas Association for the lighting of certain districts in Vienna expired last Tuesday; and the new gas-works erected by the Municipality at a cost of about £3,500,000, under circumstances which will be in the recollection of our readers, were brought into use. Some reference to this matter will, of course, be made at the half-yearly meeting of the Association which takes place to-day.

Gas Testing by the Portable Photometer.—In view of the decision of the London County Council early this year to endeavour to obtain parliamentary power to legalize the tests of gas made with the portable photometer, the Public Control Committee have sent to the Parliamentary Committee complete returns of the results of the tests made during 1898 and up to the 30th of September of the present year. The total number in the first group is 188; and, according to this system of testing, 85 per cent. of them show the gas to have been below 16-candle power. The second group comprises 149 tests, of which 90½ per cent. were below the standard. We gave in the "JOURNAL" for the 28th of March the results of the testings carried out with the portable photometer during the four years 1894 to 1897; as well as those made up to Nov. 16, 1898; and the returns now published furnish a complete record, up to within a few weeks of the present time, of the work of this instrument.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1137.)

BUSINESS on the Stock Exchange has been much disorganized during the past week. At the opening on Monday, the tone was quite cheerful, money ruled easy, and prices began to rise nicely. But on Tuesday the intelligence as to General White's extraordinary disaster at Ladysmith gave the markets a rude shock. Still, people remained quite calm, and never lost their heads; so that the set-back in prices was quite moderate. The next day was a holiday; and they had time to think over matters. When the Exchange re-opened, the tendency became rather cheerful and firm; but business was reduced to very small proportions—the disposition being rather to await further intelligence. However, prices in most departments closed higher than they opened. The Money Market was much firmer; and discount rates were able to make a material advance. During the exciting events of the week, the Gas Market was not exactly overlooked; but it was let very much alone. In fact, had it not been for some little attention which was spared to Gaslight and South Metropolitan issues, the record would have been very barren indeed. Prices all through the list remained at one dead-level; and there was nothing to indicate at all in which direction the next move might be. Only one variation in quotation was made; and that was in a stock where there were no dealings whatever marked. As an illustration of the prevailing quiet, it may be noted that on Saturday, throughout the whole list of Gas and Electric issues, numbering over a hundred, there was only one deal. Steady middle figures ruled for Gaslight ordinary and for the secured issues; and the same may be said of South Metropolitan on Friday, which was the only day on which the ordinary stock was dealt in. Commercials were never touched; but for some reason or other, the old stock was lowered two points on Friday. As for the Suburban and Provincial undertakings, one single bargain in British sums up all the labours of the week. The Continental Companies—Imperial, Union, and European—had each one transaction; and those in the remoter parts of the world presented no feature of interest. So, practically, Gas affairs were pretty well a blank last week. There was more movement in Water stocks; business being much more plentiful than in Gas. The tendency generally was towards easier figures, though only two issues actually suffered a reduction—Lambeth and New River receding two points each on Tuesday.

The daily operations require no further reference.

ELECTRIC LIGHTING MEMORANDA.

New Board of Trade Rules for Applications for Provisional Orders—The Vexed Question of Shoreditch—Rubbish Fuel is Rubbish Still—The Incandescent Electric Lamp.

THE Board of Trade have issued an amended set of rules in pursuance of section 5 of the Electric Lighting Act, 1882. The rules accordingly deal with the method of applications for Licences and Provisional Orders. The Department still treats Licences as having real existence; but practically, of course, the Electric Lighting Acts now operate by Provisional Orders. The novel point of the new rules is their reference to the provisions of the Electric Lighting (Clauses) Act, 1899. Applicants are notified that they must not set out at length in their draft Orders the various matters dealt with by the new Act, but must provide for them by incorporating the Act. Full directions are given as to applicants' procedure; and it is notified that when concurrent applications for Provisional Orders authorizing the supply of electricity within the district of any Local Authority are made by the Authority and any other party, preference will be given to the former. This declaration rather militates against the idea that toleration of competition is of the essence of the Electric Lighting Acts. Local Authorities may pounce upon it as showing that, if their applications are to be preferred to all others at the time of making, there is good reason why they should not be disturbed by later competition. It is a nice point, of which the utmost will be made by the Association of Municipal Corporations. Still, it is to be noted that the Board of Trade reserve the right of considering all applications on their merits; and they only engage to give the preference to Local Authorities where "no special circumstances exist which render such a preference inexpedient." A long and wide vista may be opened up by this exception to the general rule.

A good deal of discussion still goes on with regard to the results of the Shoreditch electric lighting and dust destruction combination. Questions have been asked as to why the much-vaunted "thermal storage" section of the plant has not come into operation. They still await an answer. Mr. Alliott, of the firm that built the destructor plant at Shoreditch, has been asked repeatedly what has become of this proposed element of the combination; but he has always avoided answering. Controversy in the correspondence columns of the "Engineer" has raged over the form of the Shoreditch accounts; and the conclusion that emerges from this criticism is that the accounts in question are "cooked." Upon whatever principle the steam produced by the destructor is valued, it seems elementary that any credit taken on this head for the destructor plant must appear elsewhere as a debit against the electricity generation account. Yet it has not been done in this example; and hence the whole affair is unreliable. The advocates of the combination owe it to themselves to straighten out the accounts, and show the result in a form that everybody can understand and appreciate. If they do not make this concession to criticism, judgment will go against them by default; and the verdict will take the shape of a cessation of orders for destructor plant.

It must not be supposed that we are opposed in principle to dust destruction by fire, with or without "utilization" of the heat of the furnaces to generate steam for electric lighting purposes. He must be indeed blind to the signs of the times who does not see that the incineration of towns' refuse by some sort of plant specially adapted to deal with this rubbishy "fuel" is the best, and often the only suitable means of getting rid of it. We do protest, however, against the interested attempts that are being made on all hands to impose upon the long-suffering ratepayer in this regard. Truly, that blessed word "utilization" has much to answer for. The Professors are at the bottom of these popular delusions. An ingenious gentleman with a long string of letters to his name delivers a lecture, or writes a letter, demonstrating that towns throw away in the shape of "dust" as much "carbon" as would suffice to supply the inhabitants with electric light. This theoretical exercise prepares the way for the enterprising firm of Jones, Brown, and Robinson, who offer to do the trick for the Local Authority—at a price. One cannot say that the whole scheme is chimerical, because has not a great Panjandrum of science shown it to be feasible? So the money goes. Then, when the cash results do not work out quite satisfactorily, the accounts are adjusted until municipalism is once more justified. Explanations which do not explain; balance-sheets which fail to balance—what does it matter, so long as the rates make everything good? Make electricity out of towns' refuse? Certainly! The municipal gas engineer could make gas out of it almost as well, if given a free hand; but in the meantime he is quite as pleased to hand it over to his good friend the electrician to the Corporation.

It is very remarkable how quickly the type form of incandescent electric lamp was settled. A good many years have passed—years of seething effort and enterprise in electrical matters—since Mr. Edison and Mr. Swan arrived at the practicable vacuum lamp, and gave it the form which it has preserved ever since. There have been alterations of the method of preparing the filament, fixing it in the bulb, and exhausting the air from the interior of the well-known pear-shaped glass vessel; but the type has never changed. This is a very striking testimony to the soundness of the work of the original inventors. Incandescent electric lamps are now made upon a strictly competitive basis; and it is hardly too much to say that the ultimate possibilities of the article are completely gauged. A good commercial 100-volt, 16-candle lamp will show a fairly steady duty up to the latter figure for between 400 and 500 hours' burning, when it will begin to fall off in illuminating power rather rapidly. Up to the same period, also, it ought to do its work at a consumption of about 2·5 watts per candle of current. This is really good working; and repute has it that some of the cheap makes of lamp are quite as good as the more expensive ones in this respect. Information is lacking, however, as to the efficiency and durability of incandescent electric lamps on currents of 230 volts, which seems to be the fashionable pressure. It is really antiquated to talk of 100-volt lamps. Many experts declare that good small 230-volt lamps are not to be had. It may be urged, in reply, that small lamps are no good, anyhow, because the comparison is with incandescent gas lighting which literally puts the electricians' pet 8-candle lamp in the shade. The point certainly needs clearing up. Even our electrical contemporaries fight shy of it.

THE BLUE-BOOK OF THE METROPOLIS GAS (POWERS OF CHARGE) COMMITTEE.

CONCLUDING NOTICE.

THE course of this inquiry has now reached the interesting juncture where the policy of Metropolitan gas amalgamations comes into question. Mr. Haward, as the voice of the London County Council, is heard in criticism, by the light of experience, of a policy which, like that of the sliding-scale and auction clauses, was adopted by Parliament upon *a priori* reasoning. It has already been remarked how Lord Farrer upheld the sliding-scale and auction clause resettlement of the London gas polity on general principles referred to the laws of probability observed to govern "ordinary traders." The last words of Lord Farrer's Memorandum of 1876 welcomed the prospect "that there will be two amalgamated Companies, one to the north and one to the south of the Thames, subject to the same conditions; and that the long and vexed question of Metropolis gas will be satisfactorily settled." The Companies had their powers of amalgamating at the time, by Acts of 1868 and 1871; and the Public Authorities regarded the idea favourably as tending to the suppression of superfluous capital outlay and to economy of working expenses. Broadly speaking, therefore, the amalgamation policy was intended to benefit the public; and the belief

of the authorities that it would operate in this sense was based on rational premises. The policy was carried out to the existing limits, which are nearly, but not quite, those expected by Lord Farrer. The difference is in the survival of the Commercial Company, which has itself been a centre of amalgamation. Lord Farrer's other expectation—that amalgamation, with the consequent extension of the sliding-scale and auction clause safeguards, would settle the Metropolis Gas Question—has been disappointed. Mr. Haward's view is that the amalgamations effected by the Gaslight and Coke Company did not prove advantageous to the consumers. He testified that "the Companies with which the Gaslight and Coke Company amalgamated were, generally speaking, more successful and more prosperous than the larger undertaking; and the prosperity of the smaller undertakings seems to have been lost in the large concern." The wonder is now how the Board of Trade could have been consenting parties to these amalgamations, in which the theoretical advantage was in the background, while the actual conditions wore a totally different aspect.

The case was so conspicuously different with the South Metropolitan amalgamations. Here the Amalgamating Company was in a better position than those which it took over. The result was that the consumers in the absorbed districts had the advantage of immediate and large reductions of price; while the advantage to the proprietors was that they came into the favourable settlement of 1876. In the long run, therefore, and on the whole, it appears to be the County Council view that even the South Metropolitan amalgamations were not to the advantage of the public. Neither the Phœnix, nor the Surrey Consumers—to say nothing of the London, as the more crucial case—would have got a standard price so high as 3s. 6d. The absorption of all these Companies who had only maximum prices, prevented the application in any part of the Metropolitan gas district of a lower standard price than that secured by the South Metropolitan Company in 1876; and this circumstance is held by the County Council to be condemnatory of the policy of amalgamation. Mr. Haward declared that the policy has benefited the Companies, at the expense of the public. Just when his evidence on this point was becoming most interesting, as showing that the South Metropolitan amalgamations were carried out without regard to the theoretical basis of the operation, Mr. Haward dropped the subject and went into the matter of coin-meter supplies. There is nothing of much moment in this part of his evidence; and in the answer to Question 240, he turned again to the general subject of London gas prices. Here he made, rather than found, an opportunity for supporting Sir Courtenay Boyle's hint respecting the doubtful proceeding of the Chartered Directorate in dispensing the full statutory dividend during the years when it was not earned. After this, witness went into the finances of the Companies in detail. In the course of this long exercise, the subject of gas-works assessment cropped up. Mr. Haward explained the method of assessment, as to which the members of the Committee confessed their ignorance. His explanation is supplemented by a paper included in the appendix, which is used to support the contention that over-capitalization is penalized by heavier rating; "but whether that is a satisfactory explanation, is another matter." This naturally led up to the question of the fact of such over-capitalization in the case of the Gaslight and Coke Company, as to which Mr. Haward had something very caustic to say. (Questions No. 371 *et seq.*) His opinion upon the matter was that the explanations of their heavy capital burden offered on the part of the Company did not appear to him to be adequate.

Mr. Pickersgill pressed witness to say what was the opinion of the London County Council of the standard prices of the London Gas Companies, and the expediency of revision. The reply was to the effect that, while the prices were regarded as high, nothing could be said at the present time about revision. Still, the opinion was that "there might arise circumstances and occasions on which it would be suitable to press for a revision of the standard prices—that is to say, that the standard prices should not necessarily stand for all time at the prices at which they were fixed in 1875 and 1876." Sir Andrew Scoble was much concerned to ascertain what effect the higher Chartered standard price had upon the different selling prices of this and the South Metropolitan Company; while some very pointed questions as to how good management can possibly be secured for all commercial undertakings were put by Mr. Banbury. From these and other questions, and their answers, there emerges the weighty observation that "the consumers are almost more interested at the present time in the economical and efficient carrying on of the business of a gas undertaking than the ordinary shareholders." This is an aspect of the sliding-scale which, if not exactly fresh, will not be liked by the administrators of sliding-scale companies whose dealings do not happen to command popular appreciation.

For several reasons, we are more concerned in these articles with what might be classified as the political evidence taken by the Committee, than with the expert gas engineer's testimony of Mr. Charles Hunt and other witnesses. It is unnecessary to commend to the careful study of our professional readers the technical statements of such masters of their business as were heard during this investigation. Certainly, we shall not attempt the arduous and interminable task of criticizing the gas engineering evidence. The answer given to a single question not infrequently suggests a whole treatise. Over and above all question of technics, towers the overshadowing problem of gas prices. Mr. A. C. Morton, as representing the City of London, went back on the policy of amalgamation. He stated, from his own recollection, that all London was persuaded "that the amalgamation of these Companies would necessarily save a lot of money in the expense of management, and consequently the gas consumers would be benefited." His grievance was that the Company which had been foremost in amalgamation sell the dearest gas. According to the theory on which the policy of amalgamation was based, "the bigger the company the cheaper the supply, because we can reduce the expenses of management." Yet the result is quite otherwise. One of the striking features of Mr. Morton's evidence was his insistence upon the selling price of gas as the only thing the consumer cares about. In addition, there was the almost pitiful invocation of competition as "the only remedy, unless Parliament can meet it by regulation." Mr. Morton was really the foil to Colonel Makins, inasmuch as the one would have it that all was wrong, whereas the other contended that everything was right. Mr. C. H. Doughty, of Shoreditch, came to sustain the complaint that the price charged for gas by the Gaslight and Coke Company north of the Thames is too high. He could not tell why; but it was, in the opinion of the Vestry.

The questions and answers recorded in the report do not disclose much of what is most important in the findings and recommendations of the Committee. In particular the evidence will be searched in vain for any suggestion of that remarkable modification of the sliding-scale which is so salient a point of the Committee's recommendations. We now leave the Blue-Book for the present, not because its interest is exhausted with what we have been able to extract from the political witnesses, but rather because any further discussion of the contents of the volume would lead straight into the region of suggestion for future action. This is distinctly not our affair.

SHAREHOLDERS AND AUDITORS.

Readers will, we trust, bear with us in making a further reference to the affairs of the Millwall Dock Company, in relation to the question of inefficient audits. We are led to do so by the report of the proceedings at the adjourned half-yearly general meeting of the Company held last month for the purpose of considering the appointment of Auditors, and by the comments that were made thereon by the organ of the profession of chartered accountants.

At a previous meeting of the shareholders, two candidates were nominated for the office of Auditor to the Company—Mr. W. Barclay Peat (the former Auditor) and Mr. James Ford, both Chartered Accountants. It was, however, announced at the final meeting, that Mr. Peat (to prevent acrimonious discussion) had withdrawn his nomination; and Mr. Ford was thereupon unanimously elected Auditor, at a higher salary than that previously paid. As regards that election, we would only express surprise that the former Auditor should have put himself forward for re-election in the first instance, and satisfaction at the recognition by the shareholders of the necessity that an Auditor should be deprived of the excuse that his remuneration did not warrant his devoting to his work the time necessary to render the audit effective. But what strikes us as really extraordinary in the proceedings as reported, is the fact that both the Chairman of the Investigation Committee who moved, and another shareholder who seconded, the motion appointing Mr. Ford, referred to the previous Auditor in terms which indicated that they thought he had been hardly used, because he had been criticized for the manner in which he had performed his duties. The first-named gentleman spoke of the Auditor as having been under the "mesmeric influence" of their late Chairman, and even seemed to think that the gratitude of the shareholders was due to Mr. Peat, because, since the frauds perpetrated by the former Managing Director of the Company had been discovered (through no sagacity, it is to be observed, on the part of the Auditor), he had taken a leading part in the investigation of the Company's accounts, which had involved him and his firm in a great deal of expense and anxiety! Really, we can only say that shareholders incapable of taking a more intelligent view of facts than to think it a virtue in an auditor to spend some time and trouble in investigating falsified accounts which, if he had adopted an efficient system of audit, could never have been falsified to any material extent or for any considerable period, and who did not thoroughly investigate the accounts because he was "mesmerically influenced" by the man he was appointed to check, deserve no sympathy for the loss which they have by those falsifications sustained. The seconder of the motion, indeed, appeared to think that no more efficient system than that adopted by Mr. Peat was practicable. Well, some people (and we are almost disposed to say the majority of shareholders) never can learn the plainest lesson.

We are very glad indeed to see that "The Accountant," when referring to this question, condemns the system of partial audits in the case of public companies. It is declared that "the accounts of even the most important undertaking can, if planned upon a suitable system, be to a large extent verified by means of tests that do not involve a detailed checking of the whole of the transactions; and unless these tests are employed to such an

extent as to satisfy the auditor himself that nothing serious remains undetected, we feel convinced our readers will agree with us that the audit is not merely unsatisfactory, but is, indeed, to a very large extent illusory, and of little worth." This is practically an echo of what was written in the "JOURNAL" when first commenting on the Millwall case six months ago; and we are pleased to see the organ of professional auditors so exactly adopting our views. We are, however, rather astonished to find our contemporary speaking, in the same article, of the unreasonableness of accusing the Auditor of the Millwall Dock Company of negligence "merely because he did not succeed in at once unearthing the system of fraud." That "at once" is delicious. Who would guess, from our contemporary's remark, that the accounts of the Company had been falsified for nearly a quarter of a century, and that Mr. Peat had been Auditor for nearly eight years?

We would recommend to the notice of auditors generally, the remarks made by the Lord Chief Justice in giving judgment on Thursday last, in the case of *Thomas v. Corporation of Devonport*. Referring to the view taken by Mr. Justice Phillimore in the lower Court, as to the duty of an Auditor of the accounts of an Urban Sanitary Authority, Lord Russell said:

> He could not assent to the proposition that the sole duty of an auditor was to take the accounts, and see that there were vouchers in respect of each payment. That seemed to him to be an imperfect and incomplete view of an auditor's duty. He thought an auditor was justified in going further than that, and in considering whether the payments were authorized payments, or whether they were illegal or improper; and, if he discovered any illegality, it was his duty to report it to the burgesses.

In other words a mere "cash audit," by itself, is imperfect and incomplete.

Before leaving this subject, we would call attention to the manner in which the Auditors of the National Bank of Wales (to the affairs of which reference was made in the "JOURNAL" for Sept. 26) discharged their duties. From the report of the proceedings taken against one of the former Directors of the Bank, we learn that the Auditors were, for some years, aware that there were matters which required investigation; but that, beyond addressing letters on the subject to the Board—which were of no avail, and were not brought to the attention of all the Directors—the Auditors took no action, and signed reports which justified the shareholders in supposing that all was right. We refer to the case of these Auditors, in order to point out that, unless Auditors make known, not merely to the Directors but also to the whole body of shareholders, the frequent recurrence of and refusal to amend doubtful entries or methods of account, the discovery of which leads them to believe that the accounts conceal the true financial position of the undertaking, they are not fulfilling their duty, and are, moreover, by signing accounts they know to be misleading, making themselves, to that extent, parties to the fraud. We would suggest that a very useful service might often be performed if shareholders would, at their general meetings, personally interrogate the auditors as to the extent of their inquiries into the genuineness of the sources from which the balance-sheets have been compiled, and as to whether they are thoroughly satisfied that these balance-sheets accurately represent the financial position of the undertaking. The sense of their responsibility would be thereby quickened in the auditors, while the shareholders might be considerably enlightened as to the value of the method of auditing commonly in vogue.

THE HOME OF COMPULSORY ARBITRATION.

A SHORT time since, in an article entitled "The Settlement of Trade Disputes by Compulsory Arbitration," we gave some account of the system at present in vogue in New Zealand for the settlement of disputes between employers and their men, and of the results of the system as observed by a member of the Legislative Council in the colony. A consideration of the provisions and working of the Act enforcing compulsory "conciliation" and arbitration, suggests inevitably the question, What manner of community is it in which such a system can exist and be tolerated? Our readers may therefore find of interest an attempt at replying to this query. For the material upon which to found our answer we are largely indebted to a very interesting article in last month's "Contemporary Review," on "New Zealand." The writer is Sir Robert Stout, K.C.M.G., who, by virtue of his long and distinguished connection with the colony, of which he was for some years Prime Minister, speaks with the authority born of intimate acquaintance with his subject.

At the outset of his article, Sir Robert Stout points out—what must be obvious to everyone who has considered the character of the labour legislation outlined in our former article—that the attitude of the colonists towards the Government is entirely different from that of the average Briton. Englishmen, with few and inconsiderable exceptions, dislike State interference. There are, we know, certain good persons who advocate State regulation of everything—especially of wages—and who think that Government can do anything, even to making a silver shilling worth a tenth part of a sovereign by simply calling it a florin. But they are, we believe, only the exception. Dr. Magee spoke an average Englishman's sentiments when he said he would rather see England free than England sober.

In New Zealand they have changed all that. Individualism, in the old English Liberal meaning of the word, is there, we are told, at a discount. The Government is no longer looked upon as a necessary evil by the people; but, on the contrary, it is believed to be the benign father and mother whose every care is for the people, who, indeed, are not considered capable of regulating their affairs without such assistance. "Colonists worship the State, and believe that the Legislature can save them from many untoward evils." This faith in the omnipotence of the State and the insignificance of the individual, has naturally had a large influence upon the laws relating to industrial questions. "Our labour laws are a product of this feeling. They have not sprung into being during the last ten years. They have grown as we have grown, and are the product of prevailing sentiment as to the duty and power of the State to remedy all grievances and to promote general happiness. Statutes regulating employment in factories have been on our statute-book for over twenty years; but the impulse to remedy ills by statute has grown much during the last ten years. Appetite in this respect has grown by what it fed on; so that the more laws we pass the more we demand. And with the increase in the number of our laws, the drastic nature of their provisions has also increased. The State's supervision over employers and employed has increased; and demands for more laws are still put forward by the Trade Unionists. . . Perhaps the most characteristic of our labour laws is the Industrial Conciliation and Arbitration Act." New Zealand is then, to all intents and purposes, a socialistic community. It is, in fact, so acclaimed by our own Fabian Society, who have in more than one of their tracts held up the labour laws of the colony as models which the workers of this country should seek to copy. They, however, while pointing to the outcome of the socialistic tendencies which they would gladly see spreading in this country, at the same time have given the very best of reasons for believing that, inasmuch as the Socialism of the colony is the child of circumstance, and not of design, events there afford no encouragement to the propagandist of Socialism here. The Society's tract on "The State and Its Functions in New Zealand" opens in this way—

> The causes of the Collectivist tendencies so often displayed in modern colonies are not far to seek. Face to face with distance and the wilderness, the individual, whilst roused to put forth all his strength, is at the same time taught his weakness. With his own hands, or those of servants, he may plough, drive, hew, build. He may make a home for himself, and supply the first common needs of life. But if this home is to be brought into touch with civilization; if his home is to be connected with the seaboard by a road even, to say nothing of railway and telegraph; if his own children and those of his neighbours are to grow up not barbarians but educated men and women—then there is but one power to invoke. Young colonies are, as a rule, too small, far off, and little known to tempt the giant capitalist from Europe. Money is too scarce amongst pioneers for them to form many rings or syndicates for the development or exploitation of their resources. That comes later. The State, and the State alone, is able to raise money in London at rates not plainly ruinous; so to the State is entrusted the main work of opening up. . . . So from the first the settler is used to the notion of co-operation. . . . Warnings against State interference do not frighten him. Is he not an active part of the State?

Clearly put, and undoubtedly true. But our socialistic friends miss the lesson. The whole pith of the thing lies in those three words: "That comes later"—"that" being the modern conditions of life. Socialism can only exist in a primitive community, and then but for a brief while. It dies a natural death so soon as wealth begins to be accumulated, and can therefore never live so long as man continues an acquisitive animal.

New Zealand, then, in common with our other colonies, will, by the natural process of economic evolution, grow less socialistic as she grows more wealthy, and, we cannot but add, more wise. The working of her labour laws will be a considerable factor in her enlightenment, there is not a doubt. They are, we feel convinced, very much more likely to be repealed in New Zealand than enacted in Great Britain—a conclusion with which Sir Robert Stout would, we gather, be by no means inclined to quarrel. "Our time," he says at the end of his article, "has been but short. One of our colonies—Canterbury—only celebrates its jubilee next year. It may take us fifty years more before we can see the effects of our experiments. If they fail with us, they must fail everywhere, for our lines have been cast in pleasant places. And if we succeed, perhaps our success may be due as much to our environment and to the qualities of our race as to our laws. Some of us may have our doubts whether in other lands differently situated our experiments can be models for universal adoption." Our opinion is something more than a doubt.

The Generation and Electrical Distribution of Motive Power.—At the meeting of the Manchester Association of Engineers on the 28th ult., a paper on the above subject was read by Mr. John S. Raworth, M.Inst.C.E., M.Inst.E.E., Past-President of the Northern Society of Electrical Engineers. In the course of it he pointed out that there are three possible sources of supply for those who desire to use electric transmission of power within their works—viz., a private installation, the local electric supply service, and a general power distribution service. The last not having yet been established, Mr. Raworth discussed the second source, on the basis of the Manchester Corporation installation, and showed that, under the conditions assumed, electric power is not more costly than steam—the special convenience of electric driving being thrown in. We hope to deal with the paper at greater length in an early issue.

A RETORT OVEN GAS PLANT.

FIRST NOTICE.

IN the course of Mr. A. C. Humphreys' address to the American Gaslight Association, reference was made to an experiment actually in progress for the supply of Boston (Mass.) with illuminating gas made as a bye-product of coke manufacture. Full particulars of the plant in question were communicated by Mr. D. F. Schniewind, of the United Coke and Gas Company, to "Progressive Age," and appear in the issues of that journal for Aug. 15 and Sept. 1 last. From this description the following account of the works has been prepared, omitting the photographic illustrations, which do not convey any information of technical value. The main idea is the chief point of interest in the undertaking; and the technical details of the plant have little to do with the justification of the venture, which depends on other considerations. Still, naturally, considerable interest attaches to the engineering and chemical arrangements.

The idea is to make metallurgical and house coke, in the immediate neighbourhood of such market as Boston can provide for the article, from washed Cape Breton slack coal received from the Dominion Coal Company, and to sell the residual gas in bulk to the local Gas Companies. The experiment is not being tried by halves. The testimony of Mr. Humphreys on this head is both candid and willing. As he says, the commercial prospects of such an undertaking depend entirely on the sale and the price that can be commanded for the coke. There is no industrial mystery about the plan of operations. Instead of making coke for the Boston market at the pit-mouth in Cape Breton Island, where most of the residual gas would be wasted, the raw material is imported to the vicinity of the market, such as it is, for all the products of carbonization. There cannot be many places where a venture of this kind would have a chance of paying. The works must be, of course, on the large scale, as Mr. Humphreys observes; and most engineers will agree with him that the plan is not suitable for general introduction. This limitation, however, does not preclude the possibility of such an enterprise answering well under suitable conditions, such as Boston appears to supply, and as might be found elsewhere.

Boston is a large centre of population—500,000, in round numbers—an ocean port, and a great railroad terminus. The climate is such that domestic stove heating is general, and on a generous scale, all the winter through. The favourite fuel is anthracite, which sells at a high price for trade and domestic consumption. Where anthracite sells, coke will sell also. Mr. Humphreys did not say so; but it may be supposed that the now ancient capture of the Boston gas supply by the carburetted water-gas party, with its consequent cessation of the local gas coke output, helped to prepare the way for this new form of gas and coke supply enterprise. This observation goes to show that the violent substitution of one kind of gas supply by another may be visited with unattended consequences. It appears that the water-gas interest, which had lately captured Boston, fought desperately against this newcomer in the field which is under the presidency of Mr. H. M. Whitney, but was powerless to keep it out. As usual in these adventures, a combination was formed uniting the owners of the raw material (the Dominion Coal Company), the owners of the Otto-Hoffmann coke-plant interests in America, and a concern called the Massachusetts Pipe-Line Gas Company. The whole scheme was realized as a local concern under the name of the New England Gas and Coke Company.

The Company acquired an extensive site for works in Everett and Chelsea counties. This covers an area of 288 acres, and has wharfage accessible by ocean steamers from Boston harbour. On the wharf is a coal-bin 432 feet long, to hold 6000 tons of coal. Facilities also exist for shipping coke, tar products, and sulphate of ammonia. The site has railroad connection; and storage for 50,000 tons of coke is provided alongside the Company's own siding. Coke cartage is also arranged for; the Company doing their own domestic delivery. All this section of the plant is reminiscent of Mr. F. D. Marshall's Copenhagen coal-handling installation. It is stated that 80,000 tons of coal can be heaped under the gantries. As the coal ports are icebound for about two months in the year, this large storage is necessary. The carbonizing plant is disposed in blocks of 400 retort-ovens, of which only one is actually built. The plans allow for three such blocks, or 1200 ovens in all. Each block comprises eight benches of 50 ovens. The future additions will be parallel to the present sets, which are placed farthest away from the wharf. The retorts are built high up above the ground, partly for reasons connected with the low-lying site, and also to admit of the coke being pushed directly into the highest railway trucks. The retorts are 33 feet long, nearly 6 feet high, and 18 inches average width, taking 6-ton charges. Great care was exercised in the building of these retorts with bricks cut true to shape, in order to save trouble with the joints. The American fire-brick was found to be more refractory than the European article; but it had the defect of shrinking considerably at high heats. The strains on coke-oven bricks are very severe, owing to the alternations of heat and cold, with damp, and the mechanical abrasion of the coke when driven out. The problem of successful coke-oven construction was therefore in the first place a question of getting a satisfactory brick. This necessity has now been supplied so successfully that ovens have been built to stand for two years without cracking or deformation.

The charging of the retorts at Everett is effected by electrically-driven machines which fill the retorts by three holes in the roof. The charge is then levelled by hand-scrapers worked through small holes in the end doors, which are afterwards luted up. The gas is taken off by a dry main—not a hydraulic dip—which is kept flushed. The first portion of the gas is, of course, the richest. The latter part is poor, and only good for heating the retorts. In order to effect the necessary separation, two distinct gas-mains—one on each side of the bench—are used to take off the gas from the charge. The ascension-pipe, say, on the left-hand side looking down the bench, is opened at first, and all the gas is sent away to the condensing and purifying plant for the town supply. After about one-half of the gas has thus been collected, the valve is closed, and that communicating with the "poor" gas main is opened. The latter portion of the product is treated for the recovery of bye-products, and is then sent into the gas-retort furnaces, where it is ignited with air previously heated to 1800° Fahr. This air supply is driven into the setting by a Sturtevant fan, not by chimney draught. It is easy to follow the utilization of this gaseous furnace heat, with recuperation. The retorts being so long, the gas heating and regeneration is arranged to act alternately at each end, by the manipulation of a Foster reversing valve. An alarm pyrometer is fixed in the waste-gas flue at each end of the setting. As soon as this indicates, by the ringing of a bell, that a temperature of 500° Fahr. exists in the flue, the attendant throws over a lever, which diverts the heating gas to the other end of the setting; and so on continuously.

This system is stated to produce a remarkably uniform heat in the retort-ovens, which is a prime essential for satisfactory working. The necessary proportions of gas and air to every retort-oven are regulated once and for all when they are first put into gait. The combustion of the fuel gas is almost theoretically perfect; the gaseous products showing less than 1 per cent. of free oxygen, and no carbon monoxide. The regenerators betray immediately whether an oven is hotter or cooler than the rest. The variation of temperatures is quite inconsiderable. Great store is set by these heating arrangements, as it is recognized that the economy of the system depends upon them. The thoroughness of the regeneration is a cardinal point of the system; and the advantage of this part of the process is demonstrated by reference to the relative volumes and weights of the fuel gas, and the air supply, required to coke a ton of coal. Roughly, $4\frac{1}{4}$ times the bulk of air to gas is required for the perfect combustion of the latter. To coke a ton of coal takes 5247 cubic feet of gas. The corresponding air supply (23,820 cubic feet) weighs 1812 lbs., and needs $1812 \times 0{\cdot}2377 = 431$ B.T.U. for every 1° Fahr. increase of temperature. As it is raised to a temperature of 1800° Fahr. in the regenerators, however—which is an increase of at least 1700° Fahr. above atmospheric temperature—the heat recovered from the waste gases by this operation and returned to the furnace amounts to $1700 \times 431 = 732{,}700$ B.T.U. for every ton of coal carbonized. Now, the fuel gas as returned to the furnaces has a calorific value of 567 B.T.U. per cubic foot. The heat recovered by regeneration is therefore equal to that which would be generated by $732{,}700 \div 576 = 1293$ cubic feet of gas for every ton of coal carbonized. On a works capacity of 2000 tons of coal carbonized daily, the economy would thus amount to 2000×1293—in round figures, $2\frac{1}{2}$ million cubic feet of gas per day. Hence the economy of the regenerator is so clearly established that at Everett the size of this appurtenance has been much enlarged, at small expense.

The expediency of heating the retorts by producer gas, as an auxiliary to, or in substitution of, the second half of the retort gas, has been considered, and, it would seem, provided for. It is doubtful from the account whether the producers are actually installed. Their presence, it is allowed, would double the output of gas from the retorts for periods of large demand. They could, of course, be charged with hot coke; and the deficiency of illuminating power of the second portion of the coal gas would have to be made good by carburetting. On the original plan of operation, it will be noticed, the perfection of the cycle depends upon the sufficiency of the second, or poor half, of the gas made, to do all the work of carbonization. It is not important that the heating gas should be an exact moiety of the gaseous product. Indeed, if 5247 cubic feet of it is requisite for this purpose, the first or "rich" portion must be a distinctly small half of the yield. Still, there must be as much of it as possible saved from the burning.

In the system of gaseous firing here sketched out, it is evident that both the fuel gas and the hot air supply are under positive, if ever so slight, pressure. At the exit end, there is a chimney shaft, which naturally shows a vacuum in the main flue which collects the waste gases from all the settings. It is therefore possible, by a permanent adjustment of the fresh air inlet pressure, and also of the damper leading to the chimney, to ensure a fairly steady equilibrium in the flues immediately surrounding the retort-oven. No cold air can enter these flues under this condition; neither can gas escape from the retort-ovens into the heating flues, to cause loss and damage by local overheating. A very steady exhaust is maintained on the "rich" gas main, with a slight pressure in the retort-oven. A vacuum exhaust is held in abhorrence, as inimical to gas, coke, tar, and everything else. The charges remain in the retort-ovens from 24 to 30 hours; the

period depending upon several considerations, among the chief of which is the character of the coke intended to be made. To make a very hard metallurgical coke, the charge is kept in until the last traces of volatile matter are expelled, which takes a long time. If, on the other hand, the coke is taken early, the result is a soft coke better suited for domestic and boiler fuel. In the ordinary way of business, both classes of trade could be served without any trouble. There is, therefore, no question of trying to force hard, metallurgical coke upon the domestic market. Anything in the way of coke that sells best can be had from the same plant, at the shortest notice. It is only a question of which coke heap—the hard or the soft—is most run upon from one day to another. There is more in this consideration than meets the eye at the first glance. The ordinary gas maker is tied to his quality of gas; not so the maker of coke according to this plan, who can produce the precise brand of his staple that happens to be in the greatest demand for the time being. At Everett work began with 100 retort-ovens, of which 60 were discharged per day. As the demand for coke grew, this number was increased to 80; but there were always more that could be emptied if wanted. It is in contemplation to speed the process of carbonization up to 24 hours, which is not expected to present any difficulty. When the oven has ceased to give off gas, which can be ascertained through peep-holes in the doors, the gas-valve is closed and the doors opened. The charge is then ready for the "pusher," which in this case is driven by electricity.

THE JUBILEE OF THE LONDON COAL EXCHANGE.

YESTERDAY week was the fiftieth anniversary of the opening of the present Coal Exchange buildings—a ceremony performed in 1849 by Prince Albert on behalf of the Queen. The anniversary was celebrated at the close of the day's business, by the dealers on the Exchange assembling and passing a resolution of loyalty and congratulation to Her Majesty, and, subsequently, by the inevitable dinner. The Jubilee could not have arrived at a more appropriate time; for the present year is one of genuine jubilation among coal-dealers and owners. There never were such times for them. From every quarter comes the same story. Contracts, which at any other time would be eagerly competed for, are actually going begging; owners everywhere being full up with orders—many even experiencing difficulty in carrying out their obligations through lack of hands.

This undoubted shortness in the coal supply is all the more remarkable, and is more clearly seen to indicate an extraordinary and world-wide commercial activity, in view of the enormous increase in the output of coal. The output tonnage of the seven principal coal-raising countries of the world has risen from 454 million tons in 1890 to 570 millions in 1898; and it is estimated that the corresponding figure for the present year will not fall much short of 615 million tons. Yet coal of all kinds is really "scarce." One of the principal causes is the revival in the iron and steel trades of America, due to her navy-building programme; and, if Germany should carry out the Emperor's proposal to double the number of her warships during the next seventeen years, a further impetus will be given to the already active iron-trade in Germany, with the certain effect of helping to maintain the price of coal. We certainly see little immediate prospect of any appreciable reduction.

Some interesting figures relating to the Metropolitan coal trade, given by Mr. F. W. Harris when moving the resolution at the Jubilee celebrations on the Exchange, help one to realize the growth of London. In 1849, the total importation of coal into the Metropolis was about 7 million tons, of which one-half—or little more than the quantity that is now carbonized by the Metropolitan Gas Companies—was sea-borne; whereas, in 1898, something like 18 million tons were consumed, 7¼ millions coming by sea and nearly 11 millions by rail. The development of the rail-borne coal business dates from about 1851; and it has been of great benefit to metropolitan consumers by its competition with the sea-borne trade. The latter has, in the past half century, witnessed the complete supersession of sailing vessels by screw steamers, to the great advantage of gas companies in particular; the supply being thereby rendered less subject to the vicissitudes of our climate, with a consequent reduction in the "safety" margin of stock required.

Mr. Harris referred with satisfaction to the abolition of the coal dues in 1890, as removing a hindrance to trade. Some large coal-users have expressed their doubts as to whether the abolition has benefited the consumer; but—especially when the competition in the coal trade is considered—there can be little doubt that, in accordance with the universal result of free trade, the direct benefit of the removal of the duty has been reaped by the consumer, while the indirect benefit of stimulated trade has accrued to the merchant. The amount of the coal dues paid during the Queen's reign is estimated at £15,000,000; and we are reminded that Holborn Viaduct, the Victoria and Albert Embankments, Queen Victoria Street, Cannon Street, and the Chelsea Embankment, as well as other works, were "built out of coal." It is satisfactory to know that the future improvements of London, of which many are urgently needed, will not be paid for out of the pockets of coal consumers as such, but by the Metropolis as a whole.

LOCAL ADMINISTRATION AND THE PUBLIC HEALTH.

THE recently issued annual report of the Local Government Board, in which is recorded the work of the Department for the year 1898-9, contains, as usual, a very large amount of information in regard to the measures adopted by Local Authorities to ensure the health and well-being of the communities under their supervision. The extent of this information may be more readily appreciated from the statement that the account of the proceedings of the Board—the report, in fact—which is signed by the President (the Right Hon. Henry Chaplin), occupies 185 pages, and that these are followed by 684 pages of appendices, in which are furnished more explicit details on the various subjects dealt with. These are arranged in five groups, embracing respectively: The work of county councils under the Local Government Act, 1888; the proceedings under the Local Government Act, 1894; the relief of the poor, and the rates levied in respect thereof; local administration and the public health; and, finally, local taxation and valuation. Although the matter collected under these headings is of general interest to everybody who is engaged in the administration of municipal affairs, that which relates to public health and local government more nearly concerns readers of the "JOURNAL" than the rest of the report; and therefore the present notice will be confined strictly to that portion of it.

First of all it will be well to see to what extent sanitary authorities have incurred indebtedness, and what they have done with the money raised. We learn from the report that the total amount of the loans sanctioned by the General Board of Health under the Public Health Act, 1848, up to Sept. 1, 1858, when the Local Government Act of that year came into force, was £2,956,178. Between that date and Aug. 19, 1871, when the Local Government Board was constituted, the Secretary of State, under the Local Government Act and the Sewage Utilization Act, 1865, sanctioned loans amounting to £7,363,366; and since then the Board have authorized the borrowing of no less than £92,134,981 by urban and rural authorities—£7,600,985 being granted last year. We have thus a total of £102,454,525, by far the greater portion of which has been authorized for sanitary improvements; and the remainder for establishing electric light stations, public baths and washhouses, libraries, &c. Of the £7,600,985 sanctioned last year, £681,875 was for purposes of water supply, and £1,663,043 for sewerage and sewage disposal, exclusive of £43.425 sanctioned to joint boards for the latter purposes. The loans authorized to be raised by town councils and sanitary authorities under Local Acts amounted last year to £4,822,654. Since the year 1873, with very few exceptions, every Local Act empowering a town council or other local authority to borrow money has provided for an annual return to be made to the Board, showing the manner in which the authority are complying with their statuory duties as regards the repayment of the money borrowed. The number of cases in which provisions are in force requiring these returns to be made is 883, inclusive of 121 cases in which the return has to be made in connection with the issue and redemption of stock. The debt outstanding in respect of the loans included in the returns made to the Board during the past year, exclusive of those made by county authorities, exceeded £108,000,000. Under section 243 of the Public Health Act, 1875, the Board recommended the Public Works Loan Commissioners to make advances last year amounting to £1,001,451 to local authorities. Of this sum, £643,300 was required by town and urban district councils, £304,022 by rural district councils, and £54,129 by joint boards. These figures are considerably in excess of those for previous years; the increase in the number of applications being partly attributable to the lowering of the rates of interest under the Public Works Loans Act, 1897. Reference is made to the important return prepared by the Board, in pursuance of an order of the House of Commons, relating to the capital and income of the water, gas, tramway, electric lighting, and other reproductive undertakings carried on by municipal corporations in England and Wales; and a tabular statement is furnished showing the total amounts of the capital and income of the undertakings in respect of which particulars are supplied in the return. The figures relating to gas, water, and electric light undertakings have already been given in the "JOURNAL" (Vol. LXXIII., p. 721).

Among the Provisional Orders issued by the Board last year, 63 were under the Public Health Act, 1875, and two under the Gas and Water Works Facilities Act, 1870. Additional powers were conferred on local authorities in regard to their gas and water undertakings; and in one case the Urban District Council of Uttoxeter were invested with the powers and duties of the Rural District Council in regard to the water undertaking in the urban district. The two Orders issued under the Gas and Water Works Facilities Act, 1870, related to the Selby urban district and the borough of Wenlock. An Order was applied for to alter the representation of the several constituent authorities upon the Conway and Colwyn Bay Joint Water Supply Board. It was petitioned against in the House of Commons; but the Select Committee decided to confirm the Order, with a slight alteration in the proposed representation. In the course of the year, 156 Orders were issued by the Board to invest rural councils with the powers conferred on urban councils. The

powers in question related in several cases to contracts for lighting purposes in the various districts, and the provision of the necessary lighting appliances.

In several instances during the year, the Board were called upon to decide upon complaints made to them as to local authorities having made default in providing their districts with proper water supply and adequate sewers; and in the cases of Hitcham and Bradford-on-Avon the responsible bodies were ordered to perform their duties within a prescribed period. In the other cases, however, time was allowed for the preparation of proper schemes. A complaint which reached the Board from Saddleworth raised an important question. A firm of millowners alleged that the Rural District Council were in default in providing sewers. Upon inquiry, the Board found that the sewers, though large enough for the conveyance of ordinary domestic sewage, were not of sufficient capacity for the reception of trade refuse. They obtained the opinion of the Law Officers of the Crown on the matter, who advised that, under the circumstances, the Council had not made default. A representation of the Portsmouth Water Company necessitated a local inquiry as to the sufficiency of the sewers at Havant and Bedhampton; but the Inspector's report was not presented in time to come within the year's proceedings of the Board. As a matter of fact, however, the two District Councils concerned were found to be guilty of default; and they were ordered to carry out a drainage scheme within six months. In certain circumstances, a district council may apply to the Board, under the Public Health Act, 1875, to determine the reasonable cost at which water may be required to be furnished to houses without a proper supply; and the Board have power, under section 8 of the Public Health (Water) Act, 1878, to fix a general scale of charges for the whole or any part of the district of the council. Nine such scales were fixed during the past year. The Board also issued an Order determining the cost of providing a supply of water in the case of each of certain houses at Marton, in the rural district of Northwich. The question of the pollution of rivers and streams occupied the attention of the Board; and five Orders were issued under the Rivers Pollution Prevention Act, 1876, and the West Riding of Yorkshire Rivers Act, 1894, consenting to proceedings being taken against manufacturers—in one instance by the Joint Committee of the River Ribble, and in four cases by the West Riding of Yorkshire Rivers Board—for the pollution of rivers and streams. Beyond these proceedings, the intervention of the Board was not required by bodies acting under the provisions of the Rivers Pollution Prevention Acts.

The Engineering Inspectors of the Board conducted local inquiries in 1159 cases, of which 66 related to petitions for the issue of Provisional Orders under the Public Health Act, 1875, the Gas and Water Works Facilities Act, 1870, and the Housing of the Working Classes Act, 1890; eleven to complaints of the default of certain sanitary authorities in the performance of their duty in the matter of sewerage and water supply; and six to applications for consent to take proceedings against manufacturers for polluting streams by trade refuse. The District Auditors of the Board were vigilant in their examination of the accounts of the various local authorities; and they made 11 disallowances and surcharges in those of town councils, 767 in those of district councils and their officers, and 13 in those of gas, water, and sewerage boards. Copies of a large number of reports—1777 in all, and relating mostly to the year 1897—made by Medical Officers of Health to district councils, were forwarded to the Board last year. The Chief Inspector under the Alkali Acts (Mr. R. Forbes Carpenter) presented his report for the past year, which has been fully noticed in our columns. Respecting it, the Board say the supervision exercised by their staff of special inspectors continues to be attended by good results. With respect to what are technically known as alkali works, Mr. Carpenter speaks in terms of decided satisfaction of the care displayed in their administration; and, although he has to confess that in some of the smaller works there is still room for improvement, he recognizes the efforts which are being made in them, in circumstances of considerable difficulty, to raise the standard of management so as to be more in agreement with that regularly obtaining in works of the highest class. The Board testify to the care generally taken to utilize, as far as possible, such improvements in the processes carried on as the growth of scientific knowledge suggests, with the view of preventing nuisance from the discharge into the atmosphere of deleterious chemical compounds.

The remaining subjects dealt with in the portion of the report under review are the Metropolitan Water Supply and Highways; and the latter does not call for notice. The former is a summary of the late General Scott's annual report, which is given in full among the appendices. We learn therefrom, with respect to the two principal sources of supply—the Thames and the Lea—that 63·7 per cent. of the whole volume of water coming down the river in September last year was taken by the Water Companies entitled to draw therefrom, as compared with 6·2 per cent. in January. The lowest gauging of the river during the year was on the 13th of the former month, when 42·3 million gallons passed over Teddington Weir, after 134·2 million gallons had been abstracted. [We may mention, in connection with this subject, that the quantity flowing over the weir on the corresponding day this year was 149·4 millions.] The average daily discharge of the Lea, added to the quantity of water abstracted for supply, amounted to 70·5 million gallons in January and 24·6 million gallons in September; the latter being less by 3·3 million gallons than the amount reserved to the use of the New River Company and the Lea Navigation. The effect of this in the period of dry weather which prevailed last year is reviewed; and the extent to which cisterns for storing water are employed in the various Companies' districts is shown. In that of the East London Company, though these appliances are used in some houses, there appears to be a great want of proper means of domestic storage. The Board point out that, with the extension of the constant service, it is the more necessary that all reasonable care should be taken to discover and check waste, which is very considerable in the East-end; and there is great difficulty in controlling it. The measures adopted by the Companies with this object are fully described. General Scott says the river water was in good condition on 327 days last year. Intercommunication of the mains—strongly advised in previous reports—had been effected to some extent at the close of 1898, but not so fully as the Board considered desirable. In view of what has been done this year, it may be expected that the next reference to this matter may be in more satisfactory terms. Mr. Allen Stoneham, the Auditor under the Metropolis Water Act, 1871, furnishes statistical details in regard to the Companies and the Staines Reservoirs Joint Committee. The former spent £469,810, and the latter £203,216, of capital on their works last year. The total amount received from the Companies by the Chamberlain of the City of London, up to the end of 1898, to form sinking funds, with accumulations of interest, was £26,654, of which £26,307 has been spent on the purchase of stock of the Companies.

The concluding section of the report deals with local taxation and valuation. The Board prepared and presented to Parliament last year returns showing the receipts, expenditure, and outstanding loans of the various local authorities in England and Wales for the financial year 1896-7. These returns, which include summaries of the accounts of no less than 30,482 authorities, will be dealt with in subsequent articles.

The Coal Trade in 1898.—According to the recently-issued report of Mr. C. Le Neve Foster on the output of minerals in the United Kingdom during last year, the production of coal, though slightly less than in 1897, exceeded 202 million tons. Had it not been for the South Wales strike, which caused a deficiency of 9 million tons from that field, the rise which had been going on since 1893 would have continued steadily. The export of coal last year was about 500,000 tons less than in 1897; but the total quantity—36½ million tons—was sufficient to cause anxiety in the minds of those who fear the depletion of the national supply. On the other hand, the price obtained was considerably higher—viz., £17,155,823, against £15,584,592. Mr. Le Neve Foster emphasizes the statement made by Mr. T. Forster Brown, in his paper on "Our Coal Supplies" at the Society of Arts, to the effect that in another fifty years the dearth of cheap coal will begin to be felt; and therefore he regards the proper husbanding of the coal resources of the kingdom as a question of national importance.

An Electric Railroad Driven by Westinghouse Gas-Engines.—In June, 1898, the Long Island Railroad began running an electric line in Huntington (U.S.A.), using three 50-horse power gas-engines at the generating station. The engines take the gas supply from the local Gas Company; the rate paid being 90 c. per 1000 cubic feet, and the amount consumed per car-mile being about 46 cubic feet. The engines are the standard Westinghouse type, with a special design of electric igniter, which takes its current from the 500-volt railroad generators after it has passed through 20 incandescent lamps (connected in four groups of five lamps each in series) and through a spark coil. When starting, the igniters are supplied by a 12-cell primary battery. This is one of the first roads to be run by gas-engines; and thus far the trial has been very satisfactory. The working expenses, including the wages of motor men and conductors, are 13 c. per car mile, which may be regarded as very good for a road on which it is only necessary to have three cars in each service, and which for most of the time are able to effectively employ but one car.

The Properties of Belgian Peat.—The numerous peat mosses in Belgium have lately been investigated by M. Petermann, at the instance of the Government Departments of Forestry and Agriculture, with the view of ascertaining the best means of utilizing these extensive natural products. He found the Ardennes peat well adapted for distillation in closed retorts; and 1000 kilos. thus treated at a temperature of 450° C. (842° Fahr.) yielded the following products: Coke, 337·5 kilos.; tar, 57·6 kilos.; acetic acid, 3 kilos.; methyl alcohol, 600 cubic centimetres. The tar was subjected to fractional distillation, with the following results: Oil distilling below 100° C., 2·5 kilos.; do. between 100° and 200° C., 12·7 kilos.; do. between 200 and 300° C., 17 kilos.; paraffin, 14·4 kilos.; carbon, 11 kilos. The quantity of ammonia produced—viz., 921 grammes (equivalent to 3630 grammes of sulphate of ammonia) is much less than might have been expected from the nitrogen content of the peat. Cyanides, formed from the distillation of the organic bases, were detected in the carbon; and a considerable volume of illuminating gas was evolved—2 kilos. of peat in one experiment having produced enough gas to supply one jet for six hours.

OBITUARY.

George Ernest Stevenson.

It is always with regret that we record the removal from the ranks of the gas engineering profession of one who has figured conspicuously therein; but the feeling is greatly intensified when, as happily is very rarely the case, the removal has taken place under painful circumstances. It was therefore with profound sorrow we had to announce last Tuesday that the explosion at the Rochdale Road Gas-Works, Manchester, of which a few particulars were then given, had inflicted such serious injuries upon Mr. George Ernest Stevenson, the Chief Consulting Engineer to the Corporation, that he succumbed a few hours after the occurrence. Mr. Stevenson was probably, like other good leaders of men of whom we have lately had some very striking examples, well to the front in directing the operations which were going on when the catastrophe happened; and he was so dreadfully burned and cut about the head that he never rallied. His death will be a great loss to the Corporation and to the gas profession; and we offer our sincere condolences with all the members of his family in their sudden and painful bereavement.

Mr. G. E. Stevenson was the eldest son of Mr. George Wilson Stevenson, the well-known Consulting Gas Engineer of Westminster; his brothers being Mr. Sidney E. Stevenson, Engineer of the Cape Town Gas Company, Mr. E. Herbert Stevenson, of Messrs. Stevenson and Burstal, and Mr. Fletcher W. Stevenson who was till lately Engineer of the Sheffield United Gas Company, and is now in practice in Westminster. He was born in the year 1848, and received his early training in the locomotive works of the London, Brighton, and South Coast Railway; completing it in his father's office. At the age of 22, he was entrusted with the management of the Tenby and Pembroke Dock Gas-Works, of which Mr. G. W. Stevenson was then Lessee. In 1871 he was appointed Engineer and Manager of the Aberdare Gas-Works; but he relinquished the position two years later, in order to take the management of works in Hungary. When he returned to this country, he was appointed Engineer, Manager, and Secretary of the Peterborough Gas Company. After filling this position for eight years, he vacated it to become Engineer of the Buenos Ayres (New) Gas Company. He remained in Buenos Ayres for six years, the last two of which were devoted exclusively to consulting work. In addition to the extensive enlargements required by the Company with which he was primarily connected, he designed and erected other gas-works in the Argentine Republic at La Plata and Paraná. The revolution of 1890, however, brought to a sudden end the "boom" of good trade which had been so extraordinary in Argentina; and Mr. Stevenson returned to England. After a short period of rest, he was appointed Manager of the Rochdale Road Gas-Works of the Manchester Corporation. It was not long before his abilities were recognized by the Gas Committee; and eventually he was raised to the position of Chief Engineer to the Gas Department. In this capacity he designed and carried out all the large extensions and improvements required by the ever-growing demand for gas in the city. As our readers are aware, it was when personally superintending the necessary alterations in the mains on the Rochdale Road works, with the view of bringing into use a new meter-house, recently completed, which formed part of the improvements carried out at that station, that Mr. Stevenson lost his life. In his capacity of Chief Engineer, he had found plenty of work to do; and the manner in which he had done it was evidenced to those of his colleagues who, under his guidance, inspected the various stations in the autumn of last year.

Besides being an able practical Gas Engineer, Mr. Stevenson possessed considerable literary ability, which he devoted to the service of the members of his profession. He joined the British Association of Gas Managers in 1873, when he was at Aberdare, and was by no means a silent member of that body. He had made a special study of retort-heating; and in 1878, after his removal to Peterborough, he contributed "Some Notes on the Construction of Retort-Settings." This was followed two years later by a paper on "Regenerative Furnaces as Applied to the Heating of Retorts," in which he set forth the advantages of the Liegel furnace, one of which he had had constructed at Peterborough. A good discussion, in which Dr. Siemens took part, was the result. He followed up the subject at the next meeting, in a paper on "The Advantages of the Regenerative System of Heating," in which he demonstrated, theoretically as well as practically, the advantage this system possessed over that of the direct combustion of fuel. This paper, which set forth with singular clearness the theory of regeneration as applied to heating gas-retorts, also led to an excellent discussion, which was opened by Dr. Siemens. We think it due to the author to say that he was one of the earliest workers on this subject; and his paper is to this day found helpful to students. Mr. Stevenson did not give any more papers to this body, which in the year 1882 became the Gas Institute; but he spoke at the meetings until he left England for South America. On his return, he attached himself to the newly-formed Institution of Gas Engineers. His first contribution was in 1894, on the subject of the new purifiers and staging at the Rochdale Road works; and it was illustrated by a goodly number of plates. In 1896 he was elected a member of the Council; and two years later became President. While at Peterborough, he was a member of the Midland Association of Gas Managers, and in 1883 contributed a paper on "Letting Out Gas-Stoves on Hire." He continued on the membership list until 1888, when his connection with that body ceased. He joined the Manchester District Institution in August, 1892, and was elected a member of the Committee in 1896, in which year he read an important paper upon "The Comparative Cost of Supplying Light by Gas and Electricity in Manchester." Many of our readers doubtless recollect the animated discussion to which it gave rise. Mr. Stevenson was Senior Vice-President of the Institution, and, but for the calamity which has taken him from us, might have succeeded Mr. Shadbolt as its President. He entered the Institution of Civil Engineers as an associate member in 1887, and was transferred to the class of members in 1889. During his membership he added to the "Transactions" of the Institution a paper on "The Gas Supply of Buenos Ayres;" and he took part in some correspondence on gas-engines which was printed in the "Minutes of Proceedings" for 1896.

In addition to his contributions to the proceedings of the above-named technical societies, Mr. Stevenson was the author of others which from time to time appeared in our columns. In 1880, he communicated articles on "The True Basis of Calculation for Estimating Economy in Carbonization," and on "The Relative Illuminating Value of the Hydrocarbon Vapours and Gaseous Hydrocarbons present in Coal Gas." In the following year, he dealt with Mr. Scott-Moncrieff's views on carbonization, and supplied an article on "The Manufacture of Water Gas." In 1882, he wrote on "Luminous and Non-Luminous Gas-Flames." His contributions, which did not always appear under his name, ceased during his residence abroad; but on coming home he wrote a series of articles descriptive of the new gas-works which he had designed and carried out for the Buenos Ayres Co-operative Gas Company. These, with the series of plates accompanying them, appeared in the volume of the "Journal" for the first half of 1891. At the time of his death he was contributing to "Feilden's Magazine" a series of articles on "Modern Appliances in Gas Manufacture," the first of which appears in the current number, accompanied by a portrait and a short biographical sketch.

Mr. Stevenson leaves a widow and seven children—two sons and five daughters. Three of the latter are married; and the elder son is following in his father's footsteps as an Engineer.

The funeral took place last Friday at Brooklands Cemetery, near Sale. A painful circumstance in connection with it was that, owing to the dangerous illness of Mr. Stevenson's youngest daughter, and to the fear lest the communication of the intelligence of the loss she had sustained might be attended with serious consequences, the body could not be removed from the Royal Infirmary to the residence of the family at Sale. The funeral procession, therefore, had to be formed a short distance from the house. On reaching the Cemetery, the Burial Service was read by the Rev. J. P. Cort, Vicar of St. Anne's, Sale, in the presence of a large gathering of the relatives and friends of the deceased. Alderman Gibson, the Chairman, Mr. Briggs, the Deputy-Chairman, and a number of members, represented the Gas Committee of the Corporation; and Mr. Charles Nickson, the Superintendent, and other officials of the Gas Department, were also present. The Manchester District Institution of Gas Engineers was represented by Mr. R. G. Shadbolt, Mr. C. Wood, Mr. T. Newbigging, and Mr. S. S. Mellor, the President, Vice-President, Treasurer, and Secretary; and also by Messrs. W. Whatmough, A. Graham, Robert Porter, W. S. Haddock, Tim Duxbury, J. E. Lamb, Harrison Veevers, W. W. Hutchinson, C. A. Craven, W. R. Chester, H. Kendrick, J. Merrell, and J. S. Naylor. Mr. William King and Mr. T. Holgate represented the Incorporated Institution of Gas Engineers. Among other members of the gas industry present were Mr. Thomas Duxbury, Mr. F. J. West, and Mr. H. Thomas. A number of the workmen from the Rochdale Road station were also in attendance. The coffin was covered with wreaths and crosses of flowers, some of them sent by the officials and workmen of the Gas Department.

Mr. E. Herbert Stevenson, writing on Saturday last, said: "Will you permit me, through the medium of your valuable paper, on my own behalf and on behalf of the widow and family of my brother, the late G. Ernest Stevenson, to thank all those kind friends who have shown their sympathies, either by communications in writing or by their presence at the funeral yesterday? The circle of sympathizing friends is so great that it is impossible to attempt to communicate with each one separately; and I trust they will accept this as a warm acknowledgment of their kindness."

The death is announced, in his 45th year, of Mr. John Blocksage, of Messrs. Thomas Blocksage and Sons, fire-clay manufacturers, of Dukinfield and Elland. Deceased was well known to the members of the Manchester District Institution of Gas Engineers, and was often at the meetings. He was at one time a member of the Dukinfield Local Board, the work of the Gas Department of which always had special interest for him.

One on whose behalf it is claimed that he was "the inventor of the gas sun-burner for illuminating large rooms" has just died at Liverpool in his eighty-ninth year. Mr. J. Gregory Jones, whether or not thus closely identified with gas, had many interests of a scientific and educational character. At one time

no man's name was so well known in Liverpool as Mr. Gregory Jones's in connection with the lectures of the College. He founded and managed the first polytechnic exhibition that ever took place in this country. This was held in the College, Shaw Street; and among the exhibits there shown were the first telegraph instrument invented by Wheatstone, and several printing presses, remarkable developments of which took place in subsequent years. It was on the model of this exhibition, held about the year 1847, that later ones, including the great exhibition of 1851, were framed.

It is with sorrow that we have to announce that the typhoid epidemic at Market Harborough has claimed as one of its victims Mr. JAMES FRYER, the Manager of the gas-works, which position he has filled for five years—first under the old Company, and, since the transference of the undertaking, under the District Council. During his occupation of the office, he has carried out some important extensions. Mr. Fryer was a native of Dudley; and was foreman at Cradley Heath before his appointment to Harborough. A few weeks since, he went for a rest to Rhyl, but returned little benefited by the change. He was then struck down by typhoid, complicated by pneumonia. His age was only 39. The funeral, which took place last Tuesday, was largely attended; Mr. Fryer having been very popular and respected in the town. His death will be greatly regretted by the members of the Midland Association, of which he was a member.

PERSONAL.

The Gas Committee of the Nelson Corporation have, out of 49 applicants, selected as Gas Manager Mr. ALEXANDER ALLEN, who at present has the management of the Neepsend works of the Sheffield United Gas Company. The Committee also resolved that, having regard to the 24 years' service of the present Manager, Mr. W. FOSTER, he be appointed Assistant Manager, at a salary of £150 per annum, *plus* the house, &c., as at present.

Many of our readers will doubtless be interested to learn that Mr. THOMAS CANNING, the Engineer of the Newport (Mon.) Gas Company, was invited to accept the mayoralty of the borough; but he thought it best to decline the offer, on the ground that his professional work during the coming year would be so heavy as to prevent him devoting the time which he considered to be due to the proper fulfilment of the duties of so important a municipal office.

Mr. J. W. BUCKLEY, the Manager of the Falmouth Gas-Works, who, it may be remembered, was a candidate at the municipal election in that town, had, on a poll of 289, a majority of 47 votes over his opponent. At Barnstaple, Mr. R. ASHTON, who holds a similar appointment, and was among the retiring members of the Town Council seeking re-election, was at the top of the poll in the North Ward; and Mr. G. DENDLE, the Manager of the water-works, was second on the poll in the South Ward, and also becomes a member of the Council.

Mr. JAMES H. GOUGH has been compelled, by reason of ill-health, to resign the secretaryship of the Thames Conservancy, which he has held for 13 years; his total service in connection with the Board extending over a period of nearly 36 years. The Conservators have, with great regret, accepted his resignation as from the end of February next; and, to show their appreciation of his long and valuable services, they have unanimously granted him the highest pension allowed under the Superannuation Act, and have also invited him to become a member of the Board.

The post of Junior Assistant Engineer at the Beckton works of the Gaslight and Coke Company, recently advertised in the "JOURNAL," has, we believe, been filled by the appointment of Mr. A. A. CARPENTER, who was formerly Assistant Manager to the Great Yarmouth Gas Company. We also learn that Mr. H. D. MADDEN, who, it will be remembered, won the first prizes at both the Polytechnic Institution and the City and Guilds of London Institute examinations in "Gas Manufacture" this year, has been promoted to the engineering staff of the Gaslight and Coke Company as a salaried pupil. Mr. Madden—who was formerly a Junior Inspector in the Company's distributing department—is to be congratulated upon this recognition of industry and ability; and we shall watch his career with considerable expectation and interest.

Some of our readers may remember that the late Sir Edward Frankland was Foreign Secretary of the Royal Society. His successor in that office is Dr. J. E. THORPE, Principal of the Government Laboratory, and a distinguished chemist. On leaving Owens College, Manchester, with the Dalton Senior Chemical Scholarship awarded to him for a series of determinations of the amount of carbonic acid in sea air, he studied under Bunsen at Heidelberg and Kukulé at Bonn. Then devoting himself to the chemical action of light, he conducted a series of photometric experiments in the Brazils with such valuable results that the Royal Society voted a grant in aid of their continuation. When the Yorkshire College was founded, he became the first Professor of Chemistry; holding the office till 1885, when he was appointed to the professorship at the Royal College, whence a few years later he migrated to the Government Laboratory.

NOTES.

Riche Wood Gas for Driving Motors.

Reference was made in a "Note" in the "JOURNAL" for the 10th ult. to the process devised by M. Riché for the production of carburetted water gas from wood; and it was then stated, on the authority of M. Lencauchez, who had investigated the matter, that the cost of producing the gas militated against its extended use, except in places where wood refuse is plentiful and coal scarce. According to some articles in "L'Electricien," the gas has been employed for producing motive power in France, Spain, and Algiers, with satisfactory results from a technical as well as an economical point of view. As mentioned in the previous "Note," the gas has a calorific power of about 340 British thermal units per cubic foot; and, when mixed with air, the maximum explosibility is obtained with 32 volumes of gas to 68 volumes of air. The cost of the gas necessarily varies with the prices of the raw materials used in its production; and these depend upon locality. On an average, 100 kilos. of wood (to distil which 40 kilos. of coal are required) produce 80 cubic metres—2825 cubic feet—of gas and from 18 to 20 kilos. of charcoal. Reckoning a metric ton of wood to cost 20 frs., and a ton of coal 24 frs., charcoal being worth 6·5 frs. per 100 kilos., the net cost, exclusive of maintenance expenses and interest, is 1·66 frs. per 80 cubic metres, or 2c. per metre. With regard to the value of the gas for motive power purposes, the following results of experiments are given in the articles in our French contemporary already mentioned: A Crossley motor of 4½-horse power when fed with ordinary illuminating gas, furnished 5·72-horse power with Riché gas consumed at the rate of 990 litres (about 35 cubic feet) per horse power; while a Charron motor of 12-horse power attained 13·95-horse power with a consumption of 807·4 litres (28·5 cubic feet) of the gas.

Washing Appliances for Factories.

In the course of a series of articles descriptive of Messrs. Loewe's machine tool works, in Berlin, appearing in "Engineering," special mention is made of the lavatory arrangements for the men. Mechanics do not need complete baths, like coal workers; and consequently good washing and wardrobe accommodation suffices for their needs. At Messrs. Loewe's works, the wash-rooms are in the way by which the men enter and leave the shops. Every man has a wardrobe, which is mounted on iron legs, so as to be clear of the floor; and it has a sloping roof, to prevent the accumulation of dust and undesirable articles. Parallel with the wardrobes, are long troughs of enamelled iron, served by overhead hot and cold water-pipes. Just at leaving-off time, the water is set running, so that the men can wash without the loss of a moment, and rinse themselves with the clean running water. Then they can use the wardrobes and change their clothes, whether coming or going. The wardrobes are thoroughly inspected every fortnight by a special sanitary officer, and are not locked. Like the wardrobes, the washing-troughs are mounted on iron legs. Where the floor joins the walls, the corner is rounded off by a fillet of cement; and the whole can be sluiced by a hose from end to end. No man is compelled to make use of these conveniences unless he likes; but the standard of personal tidiness and cleanliness is reputed to be high. Not the least important feature of these arrangements is that the Rochester Time Recorder, by which every man's time is automatically booked to him, is in his own particular shop, not at the gate. It is worth putting on record that Messrs. Loewe find no floor covering so suitable for machine shops as American maple boards, which are laid ⅞ inch thick and 3 or 4 inches wide. Six acres of this planking was imported from America for the purpose. The great advantage of the maple wood is that it is hard, and is above everything tough. If chipped, it does not splinter; and a heavy machine-tool, with a sharp-cornered cast-iron bedplate or feet, can be dragged about on it with comparative ease. Its cleanliness—especially in the matter of dust—warmth, and the great ease with which it can be repaired, are also highly valuable features.

More Hints on Paints.

Acknowledgment has already been made in these columns of the value of the hints on oils and paints which appear from time to time in the "Ironmonger." Some recent notes on the subject point out certain peculiarities of articles of this class which are worth knowing. It is remarked that the property of red lead is intensely siccative, so that it cannot be kept mixed with oil, with which it quickly sets as hard as a cement. Oxides of iron and venetian reds are also apt to set hard, if kept too long in the state of putty. It is therefore not wise to stock too much of these paints at a time. The general rule is that varnishes and oils improve, and stiff paints deteriorate, with age. Venetian reds have been known to turn out of their kegs almost like bricks. Except white lead in oil, mixed paints are never the better for keeping. With this important substance, however, a ripening or maturing interval is beneficial; but this, again, does not apply to reduced white leads. The more white lead is adulterated, the less it will bear keeping. Vermilion should always be bought in the original bags, with the seals unbroken. Our contemporary gives tables of equivalents of the weight and measurement of the principal commercial oils. The specific gravity of raw

linseed oil is given as ·9299, and of boiled linseed oil as ·9411. Cottonseed oil is very near the same specific gravity. Turpentine varies in specific gravity between ·856 and ·870. Whenever it falls below ·856 (or 8·56 lbs. per gallon), adulteration with petroleum spirit may be suspected. The cheap turpentine substitutes upon the market—of which we may expect to hear more and more while genuine turpentine remains so dear—are usually petroleum products of about ·790 sp. gr. and 120° Fahr. flash-point. For all but the best work, petroleum substitutes for turpentine may be used, and will not cost one-half the price. The use of the hydrometer is recommended as a check, although it is not a certain indicator of oil adulteration. For instance, linseed oil is often adulterated with a light mineral oil from which the characteristic "bloom" has been removed by a chemical process. If, therefore, the specific gravity of raw linseed oil should fall below ·9299, such adulteration may be assumed; but if it rise higher than ·937, a rosin-oil adulteration may be suspected. Rosin oil is more often used to adulterate boiled linseed oil; and if this were corrected by the addition of light mineral oil, the hydrometer would be useless to indicate the sophistication.

The Manufacture of Electric Light Carbons.—We have received from "The Electrician" Printing and Publishing Company, Limited, Mr. Francis Jehl's practical handbook on "The Manufacture of Carbons for Electric Lighting and other Purposes." The author, who was formerly assistant to Mr. T. A. Edison, at Menlo Park, and Engineer to the Edison Company of Paris, describes the art of making carbons, electrodes, &c., as well as the various gas generators and furnaces used in carbonizing, and gives a plan of a model factory.

Antiquity of the Turbine.—At the meeting, on Friday, of the Institution of Junior Engineers, the President (Mr. C. A. Parsons, F.R.S.) delivered his Inaugural Address, which, at the request of the Committee and Sir W. H. White, the retiring President, dealt with the subject of turbines, with which Mr. Parsons is specially conversant. In his opening remarks, he stated that the first engine deriving its motive power from fuel was a crude form of steam-turbine, which was described in the "Pneumatics" of Hero of Alexandria about 200 B.C. From this time, however, the principle was allowed to lie dormant till 1629, when it was suggested again by Bianca in another form.

Garcke's "Manual of Electrical Undertakings."—The fourth annual edition of this useful "Manual" has just been issued. Its compiler is Mr. Emile Garcke, formerly the Chairman of the Electrical Section of the London Chamber of Commerce; and he has brought together statistics relating to 500 electrical undertakings owned by companies and municipalities, besides a quantity of general information relating to more than this number of others. The extent to which the electrical industry has developed since the work first appeared three years ago is evidenced by the fact that whereas then 500 pages were ample for furnishing particulars relating to the undertakings then in operation, rather more than twice the number are now needed. There are at present 536 undertakings, with an aggregate capital of £105,977,719, as compared with 172, with an aggregate capital of £61,109,525, in 1896. As in previous volumes, the whole of the data furnished are derived from official sources; and the directory of officials contains some 3000 names and addresses. The coloured diagram, showing comparative results of working of electricity supply undertakings—a valuable feature of the "Manual"—is based on official figures as rendered in Board of Trade form. The book is well printed and bound; and the nature of its contents is shown upon the back, on which the various sections are lettered.

Troubles Arising from Electrolysis.—At the recent meeting of the American Society of Municipal Improvements, a paper was contributed by Mr. H. S. Wynkoop, Electrician to the Department of Public Buildings, Lighting, and Supplies of Brooklyn, on "Electrolysis from the Standpoint of the Municipal Electrician." In the discussion which followed, it was stated that at Peoria, where litigation is in progress to compel the street-car company to use the double trolley system, the defendants claim that this remedy is expensive and inadequate, and that a proper bonding of the rails is sufficient precaution. They also assert that the trouble is due to action at the service-boxes, and that these have since been entirely surrounded by an insulation of concrete. The electrolysis is found to be most active in sandy or gravelly soil, where it forms a kind of concrete having considerable tenacity. In Washington, all the electric car lines are to have underground conduits in the city and double trolleys in the suburbs. In Brooklyn, the contractors for the asphalte pavement have been called upon to make extensive repairs under their guarantee of maintenance; and they have repeatedly refused to do so, on the ground that the damage had been occasioned by the action of gas. The Gas Company decline to pay for the damage because they claim that the injury, if any, is due to electrolysis, and that the street-car companies are responsible. Reference was made by a member to a curious case of a pipe destroyed by electrolysis, which, although so soft as to be easily cut with a knife, retained the original coating of varnish and remained smooth without pits or perforations. He also noted that in Milwaukee a much larger electric current was observed on water-pipes near the track after the rails were cast welded than before.

COMMUNICATED ARTICLE.

SOUND GAS FITTINGS.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The labours of the Home Office Committee who recently held an inquiry on the subject of Water Gas, will not be wasted if they do no more than rouse the average consumer of gas and cause him to realize the importance, as regards his health, his safety, and his pocket, of having all gas-fittings on the premises, from the service-pipe to the tip of every burner, made thoroughly sound and gas-tight, and to understand that the attainment of such a result is worth any reasonable expense or trouble. It is all very well to talk about the ignorance and carelessness of the ordinary gas-fitter, and to ridicule the idea of any plumber, painter, ironmonger, paperhanger, or builder undertaking all kinds of gas-fitting work. Such a state of things, however undesirable, is the result of the general demand for cheap work. Unfortunately, it happens that cheap material and labour is not consistent with a sound, substantial job. Hence the reason why a taint of gas is so frequently discernible in ordinary houses, and for the by no means uncommon idea that the smell of gas is an unavoidable disadvantage attendant upon its installation. Some people suppose that the presence of gas-pipes is detrimental to flowers, apart from any question of products of combustion; and others tell you that food cooked by gas must taste of gas. These erroneous ideas no doubt owe their origin to cheap, unsound gas-fittings. The era of small pipes departed with the advent of the gas cooking-stove. People persisted in claiming that, if a pipe originally laid to supply three burners would not give an adequate result with five times that number, the quality of the gas, or the pressure, or the company must be at fault; while perhaps the next-door neighbour did not hesitate to assert that the company put on too much pressure, and caused the meter to become over-energetic, and to register more gas than was actually consumed. But a month's *régime* of underdone mutton and hard potatoes, is more efficacious than years of dim unsteady light. Whatever their views as to religion and politics, there is a unanimous agreement among householders as to the necessity for a well-cooked dinner; and after the experience just named, the consumer is usually able to appreciate the importance of proper-sized supply-pipes. In a general way, however, his education has not advanced beyond this point.

For obvious reasons, a respectable tradesman would incline to the use of first-class materials, rather than those of the cheapest kind. The style of work known as "jerry building" may find favour with a contractor who has taken a job at a fixed price, with a view of loading it with as much profit, legitimate or otherwise, as it will stand; but even he has no special affection for ½-inch compo and light brass. Cheap cutting contract work is at the bottom of the mischief. The gas consumer stands to-day in the same position as the gas companies did about half a century ago, when it was usual to let out mainlaying by contract to the lowest bidder. The gas companies soon found out that there is such a thing as leakage, and that cheap contract work was false economy. But the gas consumer has not yet learnt this lesson; and he consequently is still suffering from the disadvantages attendant upon that system. Gas companies found that light sections and inferior material were a mistake, and as soon as they asked for guarantees of soundness—such as tests under specified pressures—the manufacturers were prepared to meet them. If the householder or the architect cared to specify that the pipes must be made perfectly sound and gas-tight, any competent workman would undertake the job on these conditions; but he would require some latitude as regards the selection of the necessary appliances, and he would not put in a cutting price. If the job was placed in his hands, he would not go in for the flimsiest and cheapest lines of pipe, couplers, nosepieces, tees, taps, pendants, or brackets. There is a demand for strong, sound main and service pipes on the company's side of the meter; but it stops there, and does not extend, as it should do, right through to the burners. There is also a demand for main-layers who can look a leakage indicator in the face. But the test for soundness has not yet taken its proper place in our houses and shops, simply because there is no demand for it. If a gas-fitting contractor were to make a speciality of sound work to-day, would he be able to get 5 per cent. addition to the current contract price? It is not the ignorance of the gas-fitter, but that of the architect, the builder, and the general public, that is at fault. If it pays the gas company to lay mains in only first-class style, it will pay the consumer to be equally particular about the internal fittings.

Then the gas-fitter is blamed because, when he is sent to stop a leak, he does not put the whole system into sound condition. No doubt he makes a good job of the particular defect he is sent to cure; but there happens to be a second, or even a third, leakage that he does not know of, and so he goes away without touching them, and has to be sent for again in a few days. This may be continued till the householder's stock of patience is exhausted. Here, again, it is popular ignorance and apathy that are at fault, and not the workman. He is sent to do a particular thing, and knows very well that both the customer and his employer expect him to be smart and lose no time, but to finish up the job and report himself at the office as ready for the next. If there was a demand for persons who could make a system of

gas-fittings perfectly sound and tight, it would be met. No gas-fitter, however skilled, can, in the course of a few hours, convert a set of fittings of the cheap-and-nasty character into a first-class installation; but he will be able to say what portion required entire renewal or to state the cause of his inability. Gas companies know that it pays to spend even twenty pounds in locating and stopping a leak; but the average consumer will not expect to pay twenty pence, and besides this does not want the place upset, and will not allow a board to be taken up here, or the plaster to be disturbed there. As with new work, so it is with repairs—there is no demand for sound, first-class work.

This question is frequently landed between the two stools of owner *versus* occupier. The tenant, who has to pay for the gas, does not consider it his duty to provide the gas-fittings, or is not inclined to spend money on other people's property. The owner, if he consents to fit up the house for gas, only considers how he can get it done at the lowest possible rate. He does not care about an absolutely sound job. In every town there are hundreds of houses occupied by people who are perfectly willing to use gas, but not to pay for the pipes, and owned by landlords who are not convinced that it is to their advantage to add gas-fittings to the list of fixtures which they must of necessity provide. A satisfactory solution of this vexed problem is of more importance as regards the interests of the gas industry than the questions of hiring-out stoves and fixing slot meters, which appear to fill up the sum of the "pushing" department so far as the majority of gas companies are concerned. I may be reminded that all this is stale news—that there is nothing in the foregoing paragraphs that has not been dressed up in one form or another, and made to do duty in the "Inaugural Address" or the "paper" at least three times a year during the last twenty years, and been emphasized as many times in the editorial columns of the "JOURNAL." The reply to this criticism is that there are special reasons for considering the subject of "Sound Gas-Fittings" at the present time. The gas consumer of 1899 is a very differently constituted individual to his predecessor of 1849. The old time customer was not over-particular on the question of illuminating power; and if the gas was occasionally impure, he only made an irreverent joke about it. But the modern customer requires exceptionally good service, and then keenly criticises the price he is asked to pay; only being satisfied by the assurance that his light or heat, as the case may be, is furnished as cheaply by way of the gas service and meter as would be possible from any other source, and that everything possible has been done in the direction of beating down the price. He is also more exacting and irritable in the matter of small inconveniences, and gets as excited over a trifling escape of gas as his respected forefather would have been about an explosion that blew out a window or two. More than this, being a true-born Briton, while demanding that everything shall be made straight and comfortable, he will not have compulsion at any price. This is a free country, he says, and his views of freedem may include poisoning himself and his family by escaping gas, suffering from small-pox himself and freely scattering the contagion, or the right to thrash his wife. So we must not hope for much from the direction of compulsory legislation. If, however, the consumer is more irritable, he is in some respects more amenable to reason. The economy brought about by the use of the incandescent burner has been a useful educational agent, as showing the user that the consumption of gas is a matter largely under his own control. From this it is not a very wide step to an appreciation of the fact that a leakage of only 1 cubic foot per hour is a luxury that costs about 30s. per annum.

Many consumers will testify that it is a wise plan to shut off the gas the last thing at night, and not to turn it on till it is required next day. They have followed this plan religiously for years, under the impression that it means saving money—but in what way, they have never troubled to think. If they save leakage for sixteen hours out of the twenty-four, what about the remaining eight hours? A story is told of a man who wound his clock up regularly every morning for fifteen years, and then discovered that it was an eight-day clock. In a similar way, the gas consumer who has worked the main tap several times a week, for years, may learn that the better plan is to have the system of fittings made tight and sound in the first place, and tested once a year afterwards. There is also a tendency to mix up the question of sound gas-fittings with the respective poisonous qualities of water gas and coal gas. Some enthusiast—I think it was Winsor—claimed that coal gas taken into the respiratory organs was beneficial to health; but even if this extravagant claim was founded on fact, it is a question whether leaky gas-fittings are the best method of utilizing the supposed hygienic value. So the user of coal gas pure and simple must not be deluded with a feeling of false security, and think that, while his friends in the neighbouring town who are supplied with a mixed gas must see their fittings in order, the old style of things will do very well for him.

Gas companies who undertake gas-fitting work, or who supply fittings on hire in connection with the prepayment system or otherwise, will do well to give attention to this matter, as they thus have an excellent opportunity for educating public opinion; and while the prevention of leakage on the consumer's side of the meter is a matter that directly affects his pocket only, the gas company are not without an indirect interest. Less by leakage helps to make a big bill; a big bill makes a dissatisfied customer; and a dissatisfied consumer is a bad advertisement.

TECHNICAL RECORD.

AMERICAN GASLIGHT ASSOCIATION.

The Annual Meeting in New York.

The number of the "American Gaslight Journal" just to hand contains the preliminary notice of the proceedings at the above meeting, which, as already mentioned, was held in New York from the 18th to the 20th ult., under the presidency of Mr. A. C. Humphreys. The business was opened on the morning of the first-named day with the reading of the minutes of the previous meeting and the consideration of the report of the Council in respect of applications for admission to the ranks of the Association. There were 52 for membership, and 16 for associate membership. These were duly approved, and those of the new members present were introduced to their colleagues. The report of the Council was then taken up. In the course of it they stated that it was proposed to make the Research Committee stronger by the addition thereto of Messrs. R. Norris and A. E. Forstall. The next important item in the report was an invitation received from the Société Technique du Gaz en France for the Association to take part officially in the International Gas Congress to be held at the Paris Exhibition next year. The report was adopted; and the Secretary (Mr. A. E. Forstall) was directed to assure the French Society that the co-operation of their American brethren would be freely and fully extended. The reports of the Treasurer and Secretary, which gave evidence of the healthy condition of the Association, having been disposed of, Mr. Walton Clark, Chairman of the Trustees of the Gas Educational Fund, presented a statement in regard to the matters under their direction. It showed that the success of the work has been beyond the hopes of its most enthusiastic early promoters. The Chairman of the Committee on Research (Mr. Alten S. Miller) then submitted a short report, in which an earnest appeal was made for substantial aid to enable the Committee to prosecute their labours and put something on record. The Committee on Nominations handed in their report as to the office-bearers for the ensuing year; the selections being—

President.—Mr. G. G. Ramsdell, Philadelphia.
First Vice-President.—Mr. E. G. Pratt, Des Moines.
Second Vice-President.—Mr. W. R. Beal, New York.
Third Vice-President.—Mr. Alten S. Miller, New York.
Secretary and Treasurer.—Mr. A. E. Forstall, Montclair.

These gentlemen were unanimously elected; and Mr. Ramsdell returned thanks for the honour conferred upon him. Several invitations to visit works and partake of hospitality were then acknowledged; and afterwards Captain W. H. White introduced to the Association Mr. G. Nakagawa, the Engineer and Manager of the Tokio Gas Company, who was on a visit to America for the purpose of investigating gas-engineering practice there. Then followed the delivery by the President of his address, the text of which was given in the "JOURNAL" last week (p. 1059). A round of applause followed the reading; and the address was referred to a Committee. The papers were then taken. The first was by Mr. A. H. Stecker, of Newark, whose "Notes on Prepayment Meters" aroused a lively discussion. The second was on "The Pumping of Gas," by Mr. G. J. Roberts, of Philadelphia. The discussion on this paper brought the first day's proceedings to a close.

On resuming next morning, President Morton, of the Stevens Institute of Technology, Hoboken, delivered a lecture on "Recent Developments in Artificial Lighting." Hearty applause followed; and a cordial vote of thanks was passed to him. The report of the Committee on the President's address was next presented and adopted; and Denver (Col.) was determined upon as the next meeting-place. The reading and discussion of papers was then resumed; the order being as follows: "Another View of Interior Illumination," by Mr. F. N. Morton, of Hoboken; "Some Experiments with the Edgerton Standard," by Mr. Rollin Norris, of Philadelphia; "The Steam Consumption in a Water-Gas Plant," by Mr. Alten S. Miller, of New York; "Carburetted Water Gas as a Coal Gas Auxiliary," by Mr. A. G. Glasgow, of London. The papers were of a high order; and the discussions they provoked were useful and applicable. An "omnibus" vote of thanks, which had the saving grace of being especially directed or presented to the "readers of papers," was subsequently passed; and the meeting came to an end early in the afternoon.

On Thursday evening, the banquet of the Association took place in the principal ball-room at Sherry's Hotel, where the meeting had been held. About 300 attended; and the proceedings were, as usual, very harmonious. On Friday, the members and their friends had a sail in the harbour and bay; the course being so arranged that the party joined the fleet of boats that were to act as convoys to the *Shamrock* and *Columbia* during one of their races for the America Cup.

Photometrical Testings at the German Imperial Physical-Technical Institute.—During the twelve months ending the 31st of January last, 92 Hefner lamps were examined and certified at the Institute at Charlottenburg. Other photometrical testings made there during the same period included examinations of 207 incandescent electric lamps, 300 incandescent gas-mantles, and 42 acetylene burners.

ESTIMATION OF BENZENE VAPOUR IN GAS.

The following is an abstract-translation of a communication on this subject by Dr. Otto Pfeiffer, of Magdeburg, to the "Journal für Gasbeleuchtung."

Volumetric gas analysis approaches, in respect of accuracy, the branches of chemical analysis in which the balance is directly or indirectly used, in so far that constituents of a sample of coal gas, having a volume of 100 c.c., and weighing 0·05 to 0·06 gramme, may be accurately estimated within 0·2 per cent. by volume, which is equivalent to 0·0001 gramme. Unfortunately, however, this statement refers only to the principal constituents of the gas. It applies to the heavy hydrocarbons as a whole; but volumetric gas analysis fails to discriminate between the several groups of these hydrocarbons. But a knowledge of the nature of the heavy hydrocarbons is of the foremost interest to the gas manager, as, though their total quantity is small, their nature has a most important bearing on the fitness of the gas for different uses. Such knowledge would not only enable the illuminating power of the gas to be estimated from analyses, but would afford the data for a more reliable estimation of the calorific value of the gas than the calorimeter gives. In coal gas there are two varieties of heavy hydrocarbons which are of importance—viz., ethylene, which is a gas, and the vapour of benzene, with which are associated higher homologues, or bodies belonging to the same series of hydrocarbons. So far, however, as our knowledge of coal gas indicates, the quantity of these homologues in it falls off, in comparison with the quantity of the primary member of the series, in proportion as the homologue is farther removed from the primary member; and as there is little difference between the properties of contiguous homologues, only an error of no practical significance will be introduced if the heavy hydrocarbons are regarded as consisting merely of ethylene and benzene. More exhaustive classification and distinction of the constituents would be of little service.

The hydrocarbons of the two series known as the benzene and ethylene series differ in properties to a remarkable extent. The illuminating value of vapour of benzene is about six times that of an equal volume of ethylene; and its heat of combustion is about two-and-a-half times as great. The importance of distinguishing between these hydrocarbons in an analysis of the gas for the purpose of assessing its value, is therefore very great. The many attempts which have been made to separate ethylene and benzene quantitatively, show that the importance of finding a way of separation has been fully recognized in the past. In the sequel, the means hitherto propounded will be briefly referred to; and a new simplified experimental method, and a method of calculation, will be described.

Bunsen found the contraction due to, and the amount of carbonic acid arising from, the combustion of the heavy hydrocarbons in gas, by observing the differences between the results of the combustion of a portion of the original gas, and of a portion of the gas from which the hydrocarbons had been removed by absorption. Then indicating the total volume of heavy hydrocarbons by V, the volume of carbonic acid formed by their combustion by Vco_2, and the contraction due to their combustion by Vc, the volumes of ethylene (Ve), propylene (Vp), and benzene vapour (Vb) are given by the following equations:—

$$Ve = 5V - 2Vc$$

$$Vp = \frac{8Vc - 14V - Vco_2}{3}$$

$$Vb = \frac{2V + Vco_2 - 2Vc}{3}$$

Evidently, however, the small volumes of the gases which must be dealt with in this method of estimation require the analytical work to be carried out with the utmost precision, entailing the use of exact apparatus and the expenditure of much time. Moreover, the calculation takes it for granted that the three constituents named comprise the whole of the heavy hydrocarbons; and such an assumption is not justifiable.

W. Hempel and L. M. Dennis have attempted to determine the vapour of benzene volumetrically. They employ, as absorbent, 1 c.c. of absolute alcohol saturated with gas, in a mercury gas-pipette. The alcohol vapour is subsequently washed out of the gas by 1 c.c. of water, in a second pipette. The author has not obtained satisfactory results with this method.

Bunsen had previously used absolute alcohol to absorb vapour of benzene. He passed the gas under examination over calcium chloride, and then through a wash-bottle that contained alcohol. He separated the absorbed benzene from the alcohol by diluting it with water; and he then dried and weighed the benzene.

Bunte, in a similar manner, retains the vapour of benzene in a vessel charged with paraffin oil, and kept cool by means of ice. He deduces the amount of benzene directly from the increase in weight of the absorption vessel. According to Müller, the process gives satisfactory results if several absorption vessels are used in series.

Sainte-Claire Dèville separates the vapours of hydrocarbons in the liquid or solid state from coal gas by cooling to − 22° C., and weighing the condensed hydrocarbons. The chief defect of this method is the practical difficulty of maintaining a low uniform temperature during the condensation, which extends over one to three hours.

Knublauch has propounded a method of a rather problematical character. He determines the total quantity of hydrocarbons in the usual manner, and observes the illuminating power of the gas. Then from the known specific illuminating value of each of the two series of hydrocarbons, he calculates the relative proportions of benzene and ethylene in the gas.

Berthelot's method of separating ethylene quantitatively from vapour of benzene by means of bromine water, and absorbing the benzene by fuming nitric acid, is quite unreliable. Treadwell and Stokes have pointed out that the nitric acid absorbs also some carbonic oxide; and that bromine water attacks the vapour of benzene. In fact, many gas chemists estimate the whole of the heavy hydrocarbons by absorption by bromine water.

Harbeck and Lunge have proposed to separate ethylene from the vapour of benzene by passing the gas over platinum-black, thereby adding hydrogen to the ethylene and forming ethane, which is not absorbed by sulphuric acid. Unfortunately, this method is useless with gases—such as coal gas—which contain carbonic oxide, the presence of which renders the system inapplicable. The process has been described in our pages,* together with a second plan devised by the same chemists. This second method affords a more reliable separation of ethylene and the vapour of benzene than any of the processes described above. Briefly, it consists in drawing about ¼ cubic foot of the gas under examination through a series of ten bulbs blown in a glass tube, which are charged with 100 c.c. of nitro-sulphuric acid, which absorbs the whole of the heavy hydrocarbons. Absorption vessels charged with caustic soda retain the acid vapours, and also the carbonic acid in the gas, so that the gas passed through the bulbs is measured in the aspirator unaffected by the tension of the acid vapours. It is measured under atmospheric pressure; and the volume is reduced to standard conditions of temperature and pressure. Rubber plugs and tubing used in the train of apparatus must be smeared with vaseline to protect them from the action of the acid fumes. The acid used is diluted by pouring it on to ice, and is then neutralized with caustic alkali cooled by ice. The dinitrobenzene formed from the vapour of benzene in the gas is then filtered off. It is taken up in ether, which is allowed to evaporate; and the residue is then taken up again with a little absolute ether, filtered into a weighed dish, and the ether once more evaporated. After drying at 70° to 80° C., or over sulphuric acid in a vacuum, it is weighed. The weight of dinitrobenzene thus found, multiplied by $\frac{1}{3}\frac{3}{9}$, gives the weight of benzene; and thence the percentage by volume of vapour of benzene in the gas may be calculated. The method not only effects a quantitative conversion of the benzene vapour into dinitrobenzene, but it completely separates the ethylene, so that it seems well adapted for the examination of illuminating gas. The originators of the method, however, confess that it is troublesome, both in respect of the apparatus required and of the actual operations; and they recommend it for use only as a reliable controlling method in very important work. The exactness of the process, however, seems open to question. The measurement of the volume of the gas passed through the absorbent is complicated by the fact that it is the residual gas alone which is measured; and the total quantity of heavy hydrocarbons and of carbonic acid must be ascertained and added to the volume of residual gas, to give the true volume of the original gas. But the observation of Treadwell and Stokes, already alluded to, that carbonic oxide is partially absorbed by nitric acid, seems to make the calculation of the true volume of the gas very unreliable. The author has found that drying the dinitrobenzene by heat or in a vacuum causes a loss, as that preparation begins to sublime at temperatures below its melting-point (90° C.). Finally, the author found that dinitrobenzene of a sufficiently high degree of purity was obtained from coal gas only by very careful purification of the products of nitration.

The author's simplified method determines the vapour of benzene likewise as dinitrobenzene; but he considers that the determination is both simpler and more exact than by Harbeck and Lunge's method. The apparatus used is a stoppered separating-funnel, capable of holding about 3 to 4 litres (say, ⅛ cubic foot), and the exact capacity of which is known. The funnel is inverted, and its upturned outlet nozzle is connected by rubber tubing with the gas supply; the inflowing gas rapidly displacing the air in the funnel. When filled with gas, the funnel is closed; both the stopper and the stopcock having been previously lubricated with a little sulphuric acid. The gas within is reduced to atmospheric pressure by momentarily opening the stopcock; and the height of the barometer and the temperature of the laboratory are noted. There is then poured into the outlet-nozzle of the inverted funnel 10 c.c. of a mixture of equal volumes of concentrated sulphuric acid and fuming nitric acid of 1·52 sp. gr. By careful opening of the stopcock, this 10 c.c. of acid can be run into the funnel without the escape of any of the contained gas. The funnel is then inclined, and the acid is made to wet its interior throughout. The wetting of the walls of the funnel is repeated occasionally during the ensuing hour; the funnel in the intervals reposing horizontally in a suitable frame.

In this period, the absorption of the heavy hydrocarbons will

* See "Journal," Vol. LXXI., p. 587.

be completed. Then 100 c.c. of water is poured quickly through the ordinary mouth of the funnel, the stopper is re-inserted, and the funnel is shaken so that the water takes up the acid from the walls. The slightly warm liquid contains the products of nitration of the hydrocarbons, partly in solution, and partly, if much benzene was present, as small crystals, which render the liquid turbid. The pale yellow liquid is washed out into a smaller separating funnel, of about $\frac{1}{2}$-litre capacity. The acid is then neutralized by the addition of 40 grammes of soda crystals. A small excess of the latter is not harmful; but a large excess of alkali makes the subsequent separation of water and ether difficult. The colour of the liquid changes to reddish orange as it becomes alkaline. Next 50 c.c. of ether is added; and the funnel is agitated while held in the following manner. The right hand firmly holds in the stopper of the funnel, while the left hand holds the outlet-nozzle, which is turned upwards, so that the outlet is closed by the thumb of that hand. The stopcock remains open; and by moving the thumb of the left hand, the operator is able to release the excess of pressure, due to the tension of ether and the escape of carbonic acid, without loss of liquid. After a time, the stopcock may be closed, and the agitation continued. The clear aqueous liquid is then run off from the ethereal extract; and the latter is purified by washing twice or thrice with about 10 c.c. of water. The uncrystallizable products which would render the dinitrobenzene dark in colour are removed by the washing. The ethereal extract is washed out by means of a little ether into a 200 c.c. flask. The aqueous liquid and washings are extracted with ether a second time in a precisely similar manner. In particularly important cases, a third extraction should be made. The ethereal extracts are brought together and distilled on the water-bath. The oily residue is taken up with a little absolute ether (0·720 sp. gr.); and the light yellow solution is filtered through a funnel containing a plug of cotton wool on which is a layer of about 1 gramme of freshly calcined soda, into a weighed dish. The contents of the funnel are washed with absolute ether until the washings are colourless. The washings are run into the dish with the filtrate. The soda retains traces of water and impurities. After the ether has evaporated, the dish is brought without delay into an exsiccator charged with sulphuric acid, and left in it overnight. The dish, which contains the crystals of dinitrobenzene, is then weighed.

The percentage by volume of vapour of benzene in the gas under examination is calculated from the weight of dinitrobenzene obtained, by the following expression:—

Percentage of vapour of benzene =

$$g \times \frac{13}{28} \times \frac{1000}{3{\cdot}582} \times \frac{(273 + t)\,760}{273 \times b} \times \frac{100}{J}$$

in which g = the number of grammes of dinitrobenzene obtained;
J = the number of cubic centimetres of gas taken (*i.e.*, the capacity in cubic centimetres of the separating funnel);
t = the temperature in degrees centigrade of the laboratory at the time the funnel was filled with gas;
and b = the barometric pressure in millimetres of mercury at the same time.

This expression may be simplified by combining its constant factors, and then becomes—

$$\frac{36080}{J} \times g \frac{273 + t}{b};$$

and, as J is constant for a given separating funnel, the value $\frac{36080}{J}$ becomes reduced to a simple figure.

Harbeck and Lunge had demonstrated that vapour of benzene could be quantitatively separated from ethylene by their method, which has already been described. Nevertheless, it seemed to the author desirable to prove that his adaptation of the same principle likewise afforded a quantitative separation of those hydrocarbons. With this object, he weighed in a sealed bulb about 0·25 gramme of pure benzene, boiling at 80·4° C., and introduced the bulb into the large separating funnel. He then caused a partial vacuum in the vessel by suction, in order to give space for the vapour of the benzene. The bulb was then broken by shaking the funnel, and the benzene rapidly vaporized. Next 10 c.c. of the nitrating acid was introduced into the funnel which was manipulated as in an analysis of gas by this method, though the time occupied in the manipulation was shortened usually to a quarter or half an hour. The nitration products were also dealt with as in the analysis already described. The following figures show the degree of exactness of the method of estimation:—

	(*a*)	(*b*)	(*c*)	(*d*)	(*e*)
Benzene taken, grammes .	0·2804	0·2522	0·2258	0·2610	0·2340
„ found „ .	0·2776	0·2492	0·2258	0·2607	0·2344

The nitration, therefore, takes place quantitatively, and is completed in a quarter of an hour. It was further established by trial that cooling the nitrated mixture by ice on its dilution was superfluous, and that drying the dinitrobenzene in the warm or in a vacuum leads to loss. Indeed, the dinitrobenzene may be completely sublimed at 70° to 80° C. The author's earlier estimations, in which he dried the product at that temperature, failed on this account. Harbeck and Lunge were able to secure satisfactory results because the quantities of dinitrobenzene weighed by them were very much greater. The following are the results of some determinations of the vapour of benzene in coal gas. It should be mentioned that *a* was carried out by Harbeck and Lunge's original method; *b*, by the use of Rüdorff's apparatus for the estimation of carbonic acid, but in other respects according to the author's method. The other tests were made by the author's method; and *g* and *g*¹ refer to crude gas, at the inlet and outlet respectively of a "Standard" washer:—

—	Volume of Gas Taken.	Barometric Pressure.	Temperature.	Percentage of Vapour of Benzene Found.
	Cc.	Mm.	° C.	
a	10,570	759	22	1·15
b	1,163	762	26·5	1·82
c	3,411	764	23	1·51
d	3,411	762	23	1·55
e	3,411	760	17	1·72
f	3,411	766	19	1·52
g	1,398	759	26	2·13
*g*¹	3,411	759	26	1·97

A calculation of the amount of vapour of benzene may be made from the analysis and the specific gravity of a gaseous mixture, just as, conversely, the specific gravity of such a mixture can be calculated from the analysis and the specific gravity of the constituents. If the specific gravity of the gaseous mixture = S, the mean specific gravity of the whole of the heavy hydrocarbons (C_nH_m) present in it = s, and the symbols a, b, c, d, e, f = the percentages by volume of carbonic oxide, marsh gas, hydrogen, nitrogen, carbonic acid, and heavy hydrocarbons respectively, then

$$s = 100\,S - (0{\cdot}9671\,a + 0{\cdot}5530\,b + 0{\cdot}0692\,c + 0{\cdot}9701\,d + 1{\cdot}5197\,e)\,\frac{1}{f}.$$

Thus in a gaseous mixture of which the specific gravity (S) was found experimentally to be 0·3882, and of which the analysis gave the figures shown below, the specific gravity (s) of the heavy hydrocarbons would be found in the manner shown:—

Constituents.	Percentage by Volume. (x)	Specific Gravity. (y)	($x \times y$) Weights.
Carbonic oxide . . .	8·4	0·9671	8·123
Marsh gas	30·7	0·5530	16·970
Hydrogen	54·2	0·0692	3·751
Nitrogen	1·5	0·9701	1·455
Carbonic acid . . .	1·4	1·5197	2·127
Heavy hydrocarbons .	3·8	s	..
			32·426

$$\text{Therefore } s = \frac{38{\cdot}82 - 32{\cdot}43}{3{\cdot}8} = 1{\cdot}682$$

The specific gravity s refers to the mixture of heavy hydrocarbons consisting chiefly of ethylene and vapour of benzene. On the presumption that the higher homologues have little importance, because the quantities of them are very small, the value s will always lie between the specific gravity of ethylene (0·9674), and that of the vapour of benzene (2·7041). It will approach more nearly to the one or the other of these values, according as ethylene or vapour of benzene predominates. Hence it follows that the quantities of ethylene and benzene in the mixed hydrocarbons stand in inverse ratio to the differences between their specific gravities and that s of the mixed hydrocarbons. Thus—

Ethylene : Benzene :: $(2{\cdot}7041 - s) : (s - 0{\cdot}9674)$

If the total volume (v) of heavy hydrocarbons has been ascertained by analysis, the percentage of vapour of benzene in the gas can be calculated thus—

In $(2{\cdot}7041 - s) + (s - 0{\cdot}9674)$ volumes of heavy hydrocarbons there are present $(s - 0{\cdot}9674)$ volumes of benzene. Therefore in v volumes of heavy hydrocarbons, there will be

$$\frac{(s - 0{\cdot}9674)\,v}{(2{\cdot}7041 - s) + (s - 0{\cdot}9674)} = \frac{(s - 0{\cdot}9674)\,v}{1{\cdot}7367}$$

volumes of benzene vapour.

The quantity of ethylene is determined by deducting the amount of vapour of benzene found from the total quantity of heavy hydrocarbons. In the example of an analysis already given, the amount of benzene present would appear by calculation to be—

$\frac{(1{\cdot}682 - 0{\cdot}9674)\,3{\cdot}8}{1{\cdot}7367} = 1{\cdot}56$ per cent. of vapour of benzene; and therefore the amount of ethylene would be = 2·24 per cent.

Critical consideration of this method of calculation leads in the first place to the conclusion that the wide difference in the specific gravities of ethylene and vapour of benzene is very favourable to the return of reliable results from its application. On the other hand, the inherent weaknesses of the process must not be overlooked. An exact complete analysis of the gas is needed; and the determination of the total heavy hydrocarbons in particular must be free from error. An error of 0·2 per cent. in this determination would, in the foregoing example, have made a difference of 0·1 in the percentage of benzene found.

The effect of the higher homologues of ethylene and benzene cannot be of much moment, as it diminishes with the quantity

present; and this quantity in coal gas is relatively very small. Practically their presence in the gas is compensated for in the results, as they possess higher illuminating value and higher calorific value as the molecular weight increases; so that an increase in the specific gravity (*s*) due to higher homologues, causes an apparent increase in the quantity of benzene vapour present, and the vapour of benzene has a higher illuminating value than ethylene. Hence, so far as the valuation of the gas in respect of illuminating power is concerned, the results obtained by the method are reliable, and are of more practical utility than would be an exact determination of the vapour of benzene alone. The weakest point in the process is the determination of the specific gravity of the gas experimentally, as the apparatus in vogue for this determination does not give sufficiently accurate results.

The gas-balance does not, as a rule, give results which are accurate even to the second decimal place. The Bunsen-Schilling effusion apparatus gave concordant results in a series of tests; but the numbers obtained are at best only approximate, and unreliable *beyond* the second decimal place. A difference of 0·005 is of frequent occurrence; and an error of this magnitude in the determination of the specific gravity would in the example cited above, cause an error of 0·3 in the percentage of vapour of benzene found. But, by taking the mean of several determinations of the specific gravity of the gas, the author has secured by the method of calculation very satisfactory results, which agree closely with those obtained by the nitration method. Thus, it will be seen that the amounts of benzene and ethylene in five samples of gas, calculated from the appended analyses, agree closely with the results obtained by the nitration method, which have already been quoted under tests (*a*), (*b*), (*d*), (*e*), and (*f*) in the table given above.

Constituents of Gas.	Volumes per Cent.				
	(*a*)	(*b*)	(*d*)	(*e*)	(*f*)
Carbonic oxide	8·4	8·7	8·4	8·7	8·0
Marsh gas	31·4	28·8	30·7	30·2	31·5
Hydrogen	53·6	56·0	54·2	54·3	54·1
Nitrogen	1·2	1·5	1·5	2·0	1·6
Carbonic acid	1·4	1·5	1·4	1·4	1·4
Hydrocarbons ($C_n H_m$)	4·0	3·5	3·8	3·4	3·4
Specific gravity of—					
Gas (S)	0·3761	0·3816	0·3882	0·3906	0·3860
Hydrocarbons (*s*)	1·6250	1·7710	1·6820	1·8000	1·7710
Calculated percentage of—					
Benzene vapour	1·28	1·62	1·56	1·63	1·57
Ethylene	2·72	1·88	2·24	1·77	1·83
Percentage of benzene vapour by the nitration estimation	1·15	1·82	1·55	1·72	1·52
„ of ethylene by the nitration estimation	2·85	1·68	2·25	1·68	1·88

The foregoing results indicate that the determination of benzene and ethylene by calculation from the specific gravity and analysis of the gas suffices for general use, and serves to complete the analysis. But occasionally controlling determinations should be made by the nitration method, and the extent of the agreement of the results observed, with gaseous mixtures of different composition. The precision of the method of calculation will be greatly enhanced by elaboration of more nearly perfect methods of determining the specific gravity of gas.

Diatoms in Drinking Water.—Messrs. G. C. Whipple and D. D. Jackson have reprinted from the "Journal" of the New England Water-Works Association a paper on the *Asterionella formosa*, a diatom which sometimes appears in great quantities in reservoirs of drinking water, imparting to it a geranium-like or fishy odour, from the production of a substance analogous to the essential oils. Its development is seasonal—appearing chiefly in spring and autumn. Its growth is greatly favoured by strong light; and the most efficacious preventive appears to be the storage of the water in the dark.

The "Practical Engineer" Pocket-Book for 1900, which has just been issued by the Technical Publishing Company, Limited, Manchester, is rather more bulky than its predecessors, owing to the adoption by the Editor of various suggestions made to him for improving the work. Much of the matter has been recast, and arranged as far as possible in logical order—a full index being provided to facilitate reference. The chapter on "Gas and Oil Engines," which occupies 22 pages, is by Mr. F. Grover, Assoc.M.Inst.C.E., of Leeds, who also furnishes some tabulated results of experiments made by him on explosive mixtures of acetylene and air. The book is bound in leather, gilt—the diary being on ruled section paper; but it can be had without the latter.

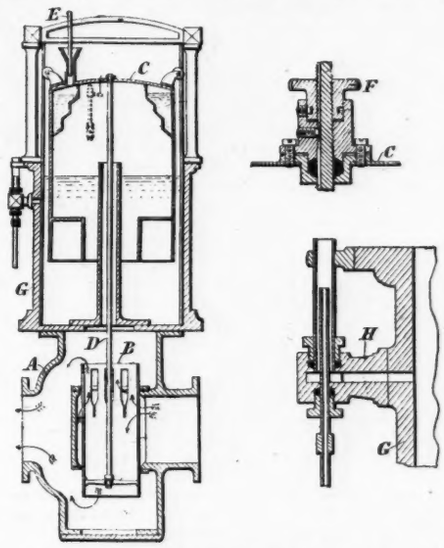
REGISTER OF PATENTS.

Gas-Governors.—Simpson, S., of Exeter. No. 23,547; Nov. 8, 1898.

This governor is of the type in which the valve is controlled by a tapering bell or float (or a float of varying area) in such manner as to reduce or increase the outlet pressure as the bell or float is raised or lowered.

The illustration shows the governor itself; a section, drawn to an enlarged scale, of the arrangement for adjusting the working pressures; and a section showing a modification of the adjustment.

The circular valve-chamber A is provided with an inlet-pipe having an extension projecting into the chamber. In circular seats or fittings in the top and bottom of the extension, there works a valve B suspended by a cross-bar and rod D from the bell or float C; the valve being in the form of a vertical hollow cylinder. It is provided with a series of slots or notches at its upper end; while the lower part is plain. The slots are of tapering or varying width, so that, when the valve is in its uppermost



position, the plain portion extends through the part of the inlet-pipe between the top and bottom seats, and prevents any gas passing. When, however, the valve is lowered (owing to the reduction of pressure within the bell), the slots in the valve are brought below the upper seat or fitting, and thus extend more or less into the inlet-pipe, and allow gas to pass (in the directions indicated by the arrows) to the outlet.

The bell C, which has parts of varying internal diameter, has the outer wall of its greatest diameter continued upwards throughout its height as shown; and the annular space between the reduced or tapering inner part and the outer wall is utilized as a loading tank for weighting the float. This tank is provided with a tube extending upwards from the cover, within which slides the lower end of a water supply-pipe E.

The range of working pressure—that is, the area of the float on the water-line corresponding to a given position of the valve—is varied by raising or lowering the water-line. For this purpose, the outer casing G, containing the usual water-seal, is provided with an adjustable overflow-pipe, sliding in a stuffing-box of a hollow bracket H (the interior of which communicates by a hole with the interior of the tank or casing G). The pipe is surrounded by an open-ended glass tube secured by a gland in the bracket, whereby the acting area of the bell can be varied for a given opening of the valve; while by means of the glass tube the level of the water-seal may be observed.

A modification by which the same object may be effected is shown. Here the valve-rod extends upwards through a stuffing-box in a socket fixed to the top of the bell; and the upper end of the rod is screwed so as to engage in a nut F, whereby the rod, being prevented from turning, may be raised or lowered by turning the nut F, so as to vary the position of the valve with relation to the different areas of the bell or float.

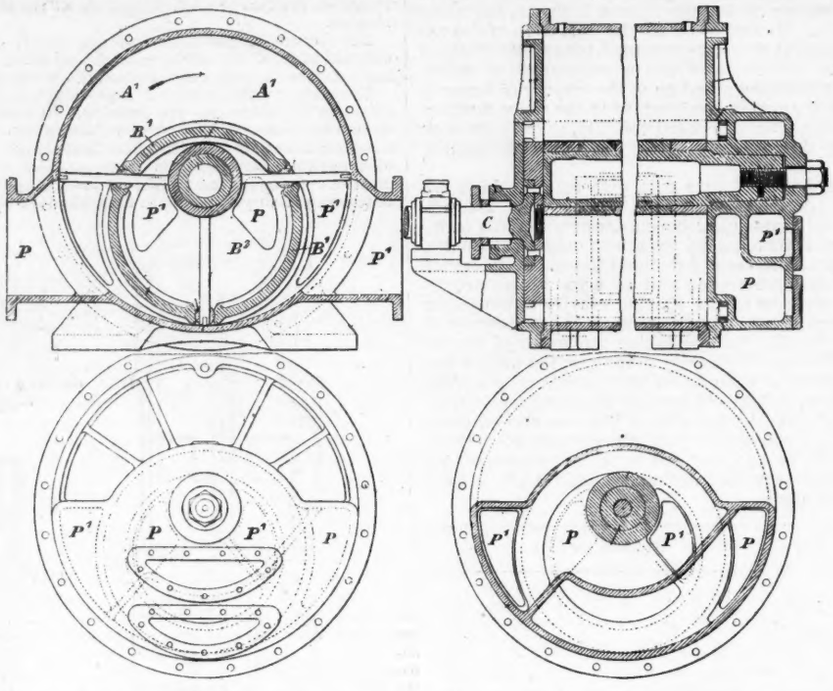
Rotary Exhausters.—Sharp, J., of Glasgow. No. 21,340; Oct. 11, 1898.

The patentee claims as the main feature of his invention a combination of the parts of a rotary exhauster, pump, or blower, with the blades mounted loose on a central spindle, and made to revolve round the centre by an eccentrically arranged revolving barrel and inlet and outlet ported connections to the inner and outer chambers, as shown in the accompanying engravings.

On a central stationary hollow shaft within the casing—next page—is mounted a series of (preferably three) radial arms or blades, with hinge eyes at spaced distances apart. A hollow barrel or drum B^1 is mounted eccentrically within the outer casing; and where the blades pass through it to the circumference of the outer casing, the barrel is fitted with long slotted circular tongue-pieces, to form a universal joint, so as to be automatically adjustable to suit the varying relative angles of the blades during each revolution. The inner barrel B^1 has a central shaft C at one end, either coupled direct to an engine crank-shaft or driven by gearing, so that when the barrel revolves the blades are carried round with it. In order that the interior B^2 of the revolving barrel may be utilized for pumping in addition to the outer casing A^1, the outside diameter of the hinged eyes of the blades is made to touch the inside circumference of the barrel at certain points, so as to prevent the passage of gas—the centres of the barrel and of the eyes being eccentric to each other.

In order to render it unnecessary to stop the passage of gas in the way referred to, the inlet and outlet ports P P^1 respectively of the inner and outer chambers B^2 and A^1 may be formed so that, by the passage of the

blade when revolving in the direction indicated by the arrow, the opening of the inlet-port to the upper portion of the inner barrel B^1 is coincident with the shutting off of the outlet-port to the same space by the blade opposite. Thus, even when there is an open space between the outer eye and the inner surface of the drum B^1, the passage of gas from the outlet to the inlet side is prevented by the blades alone, and not as previously described by contact. The blades exposed in the outer chamber A^1 and inlet and outlet ports thereon are also arranged so that the passage of gas at the bottom between the outer surface of the revolving barrel and the inner surface of the outer casing is entirely prevented by the blades opening and shutting in the manner described for the inner chamber B^2, so as not to depend on contact; and any gas which might pass through



the space at the bottom left between the outer surface of the barrel B^1 and the inner surface of the casing, would be stopped by the blades alone, one of which is always in action, and intercepts the return flow. By this means, the leakage which would take place between the two points of contact—that is, between the inner surface of the revolving barrel B^1 and the outer surface of the eye, and between the outer surface of the revolving barrel and the inner surface of the outer casting—is prevented.

By a further modification, the revolving barrel may be made open right through, and be kept in position by working in circular grooves formed in the end covers; and in contradistinction to the mode of driving described (in which the barrel is driven direct, and carries with it the working blades), the patentee purposes to mount a shaft centrally to the outer case, so that it may pass through stuffing-boxes in each end cover, and be supported at each end. On this shaft, one of the blades is fixed securely at the eye by means of keys or feathers; and the other two blades are mounted loose on the same shaft, in order that they may be free to take up the continually changing relative positions of blades. The shaft with its fixed blade now becomes the main driver, and may be coupled to an engine; and when in motion, the fixed blade is carried round with it so as to drive and produce the circular motion of the revolving barrel, which in turn carries round the two loose-mounted blades. The gases pass direct through a port into the outer casing, and discharge through a similar port on the opposite side. In addition to this, the gases are also conducted from the inlet side through a port on the end cover into the interior of the inner barrel, and are discharged through another port diametrically opposite to it. By this means, the inner area of the revolving barrel is filled and discharged three times in every revolution, in addition to the three volumes discharged between the outer casing and the barrel each revolution.

Coin-Freed Prepayment Meters.—Tourtel, J., and the Tourtel Gas and General Engineering Company, Limited, of Aldersgate Street, E.C. No. 24,180; Nov. 16, 1898.

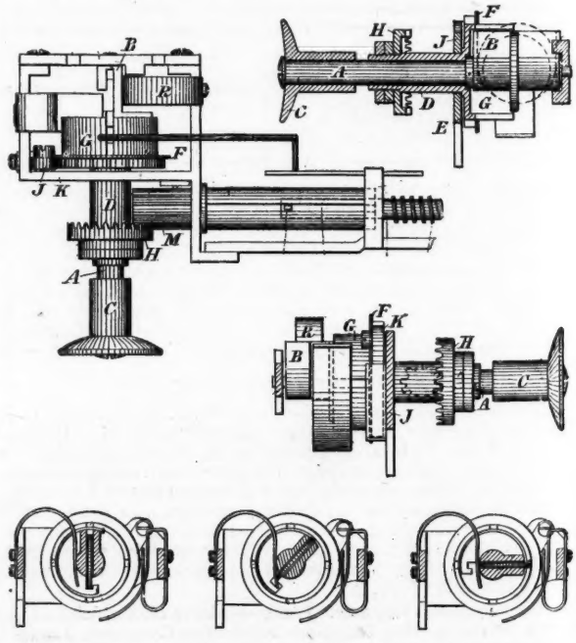
This is an improvement on the mechanism described in patent No. 28,960 of 1896, whereby the coin-operating handle of the meter may be brought to the front instead of being at the side, and the two change-wheels previously employed may be replaced by a removable crown-wheel, which can be readily changed so that two coins of different values may be used to operate the same apparatus.

The illustration shows a plan and two sectional side elevations of the coin-operating mechanism employed.

The operating spindle A is provided with a coin-pocket B near its inner end, and an operating handle C on its outer end. D is a sleeve working loosely on the spindle, and provided at its inner end with a disc E, having ratchet-teeth cut in its periphery, an annular guard F, and a cylindrical flange G, with four slots equi-distant from each other. Upon the outer end of the sleeve is mounted a crown-wheel H; while the sleeve itself is supported by the frame J, upon which is mounted a pawl K, engaging with the ratchet-teeth of the disc. The inner end of the operating spindle is supported by a plate secured to the frame, and provided with two stops, which limit the travel of the coin-pocket to about half a revolution.

Gearing with the crown-wheel is a long pinion M, fixed to a long sleeve, supported at one end by the frame and at the other end by a bracket. A measuring-out spindle works in the sleeve, and is provided with a screw or thread so arranged that, upon the spindle being turned, a supply-valve is opened, and additional apparatus in connection with the screw [which additional apparatus, not being the subject of this invention, it is unnecessary to more fully describe] is set back in such a manner that the ordinary gearing of the meter train can operate and return the additional apparatus to its normal position, and thus close the supply-valve, while the screw or spiral is unaffected by the return motion. By varying the proportion between the number of teeth in the removable crown-wheel H, different quantities of gas may be supplied.

In order to enable coins of two different values (such as pennies and halfpennies, or shillings and sixpences) to operate the mechanism, a spring R is provided, fixed to the frame of the mechanism; the free end



being so disposed that, when a coin has been introduced into the coin-pocket and the handle slightly turned, the lower edge of the coin is brought against the spring, and the continued movement of the operator causes the coin to be lifted. In the case of the larger of the two coins arranged to operate the mechanism, a mechanical connection between the operating spindle and disc is effected immediately upon the introduction of the coin into the apparatus, because the larger coin will be supported by a lip upon the coin-pocket, and will project into one of the slots of the disc-flange. But in the case of the smaller coin, no such mechanical connection exists, because, owing to its smaller size, the coin is entirely contained within the coin-pocket, and is thus unable to

engage with the corresponding slot of the disc-flange. Upon turning the handle, however, this smaller coin is lifted by the spring; and when the operating spindle has been turned through half the normal distance, the coin engages with the second slot of the disc-flange, and upon continuing the motion the disc itself is turned until the coin-pocket encounters a fixed stop, when the coin will drop. Thus the effect of the smaller coin is only half that of the larger one.

Gas-Engine.—Boult, A. J.; a communication from W. S. Sharpneck, of West Grossdale, Ill., U.S.A. No. 13,808; July 4, 1899.

The main feature of this invention is the provision of a reversible gas-engine, which is said to be "simple in construction, cheap to make, economical in running, and not likely to get out of order." The reversing motion is attained by providing the cylinder of the engine with an inlet-port, two exhaust-ports (substantially in a line transverse of the cylinder), and a valve arranged to close one exhaust-port when the other is opened, with a piston travelling in the cylinder, and mechanism for partially rotating the piston to cause a port in the piston to register with all the ports in the cylinder. The engine is made self-governing by forming the exhaust-ports of a size corresponding to the speed at which the engine is to be run. If they are small, the engine will not run so fast as if large, because if they are small, and the engine is speeded up, the exhaust is not brought down to atmospheric pressure, as the port in the piston travels so quickly that the exhaust has not time to get out entirely. Thus the small pressure remaining prevents just that much vacuum being formed—less the charge taken into the cylinder—and makes a lighter explosion, which consequently brings the speed of the engine down to where it admits of the proper vacuum being formed.

Gas and Oil Engines.—Walton, J., of Birmingham. No. 15,114; July 22, 1899.

This invention—applicable to gas or oil engines having one or more cylinders as required—has for its object "to simplify the construction of the valve mechanism, thus reducing the first cost; and avoiding much wear and tear, and liability of the delicate parts now used getting out of order."

The patentee claims as his invention: (1) A motor engine worked by explosive fluid, and wherein a single cylinder may be used, or two, three, or four cylinders may be combined, the use of a rotary disc-valve provided with all the ports or passages for performing all the required functions of admission of gas and air, and also of exhausting the products of combustion. (2) A disc-valve provided with all the ports necessary for admission and discharge, revolving concentrically with, but at half the speed of, the crank-shaft. (3) A gas-engine of two, three, or four cylinders, having a disc-valve between the cylinders provided with concentric segmental passages for the admission of gas and air; and communicating at each revolution with passages to the cylinders, and with the exhaust-passage. The valve is caused to revolve at half the speed of the crank-shaft—supplying, controlling, and exhausting all the cylinders.

Manufacture of Gas.—Johnson, W. B.; a communication from J. A. Faux, of Pittsburg, U.S.A. No. 16,036; Aug. 5, 1899.

This invention relates to the manufacture of gas by the intermittent system, and more especially to the making of combined coal and water gas. Its object is "to more completely utilize the gaseous contents of the coal, to prevent the escape of gaseous vapours during the regenerating of the fuel-bed, to more completely heat the coal layer upon the fuel-bed during the gas-making periods, to positively draw the heat from the fuel-bed upwardly through the layer of coal, and to quickly remove the vapours and gases generated from the coal at a low temperature."

The generator A (in the form of the inverted frustrum of a cone) is provided near its lower end with the usual grates, air-inlets, and steam-jet inlet below the grates. The top of the generator is of dome form, with an annular passage B therein, having a series of ports leading into the generator above the fuel-bed. Above the central opening in the top of the producer is the charging-hopper mounted upon wheels so that, if desired, it may be detached and moved to one side—the charging-opening then being closed with a cover, if water gas alone is required. The lower end of the hopper is provided with a flanged ring to facilitate its removal. It is arranged as shown in the enlarged detail. Thus, when the hopper has been filled with crushed or ground coal and the charging-opening closed, the shaft C is lowered and simultaneously rotated until the disc D is within the charging-opening of the producer. As the coal in the hopper falls through this rotating disc, it is thrown outwardly in all directions, and thus spread evenly upon the fuel-bed. The shaft is then raised into its normal position, so as to protect the disc and actuating connections from the heat generated in the producer.

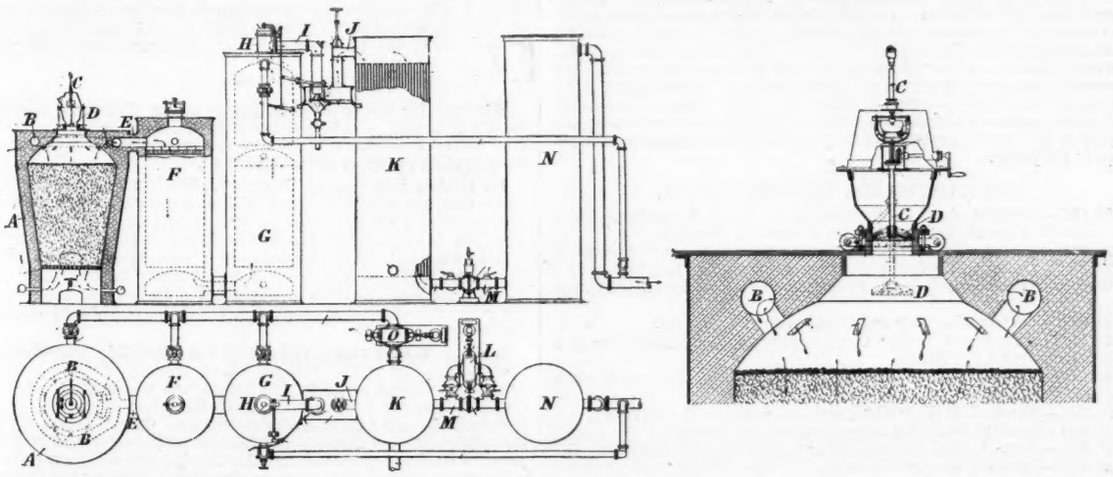
The gas is drawn from the producer, through an outlet E, into the upper end of a fixer F, connected at its bottom with a second fixer G—both filled with checker-bricks. The gas then rises into a vertical pipe H, and thence through the pipe I downwardly into the valve-chamber, from which the pipe J leads to a condenser K. The gas entering at the top passes down through the series of pipes therein, and is taken out at the bottom through a pipe connected to an exhauster L. From the exhauster the gas is forced back into the bye-pass M, which directly connects the condenser with a scrubber N.

O is a blowing engine to which a supply-pipe leads from the top of the condenser; the air taken in at the lower end of the condenser being warmed as it rises through the condenser by its contact with the pipes through which the gas is passing. It is forced by the blower into a pipe, from which a branch is led to the gas-producer, and connected to the air-inlets. Other branches lead to the fixers, and are continued upwardly to an air-inlet in the central portion of the second fixer.

In working this apparatus, when it is wished to make combined coal and water gas (assuming that the producer is filled with a body of coke, which extends from the grates upward to a point near the lower end of the dome), a thin layer of crushed soft coal is spread upon the previously heated coke-bed, and the distributing disc drawn upwards into the lower end of the hopper. The exhauster then acts through the connected fixers and the condenser, draws off the gases and vapours rising from the thin coal-film, and these gases are taken off through the several ports, and collected in the annular passage, whence they pass to the first fixer.

The action of the exhaust is to draw the heat of the fuel-bed upward through the coal-film; and the gases rising from this film are thus taken off quickly and at a comparatively low temperature. During this period the air-blast is cut off; and steam being supplied beneath the grate, rises through the heated fuel-bed and is broken up into water gas—this gas combining with the coal gas, and the mixture passing off into the fixer. The mixture of gases flowing through the heated checkerwork of the fixer is converted into a fixed gas; and it thence passes through the condenser and scrubber, where the foreign matters are eliminated.

When the heat of the fuel-bed has been lowered during this operation to a point where water gas is not generated, the steam admitted below



the grate-bars is shut off, air is blown in, and combining with the fuel raises the fuel-bed to a high temperature; while the heated products of combustion flowing through the fixers heat the checker-bricks therein, and are passed into the outer air at the upper end of the second fixer. When the fuel-bed has been thus brought to the desired temperature, a fresh supply of coal is spread over the fuel-bed, and steam is again admitted below the grate—thus resuming the gas-making period. These periods are, of course, alternated in the usual manner.

The patentee calls special attention to the fact that—owing to the drawing of the heat from the fuel-bed upwardly through the film of coal, and owing to the large area of this film of crushed coal compared to the grate area, and the thinness of the film—the coal therein is "thoroughly carbonized during each gas-making period," which occurs immediately after the coal is fed. This, he says, is a very important part of his invention, since the coal is thoroughly carbonized, and the gases quickly drawn off at a comparatively low temperature—thus obtaining substantially all the gaseous constituents of the coal, which combine with the water gas, and pass over to the fixing-chambers. The making of the coal-film of larger area than the grates is therefore highly important, as well as the drawing off of the gas at several different points, and the use of an exhauster, which acts to positively draw out the gases generated. The advantages of the invention are thus set out: The use of a vacuum apparatus or exhauster in connection with the intermittent system positively draws away the gases rising from the coal-film, and ensures its carbonization. The large area of the coal-film also assists in this action, as do the several ports for the outlet of the gas. The drawing of the heat from the fuel-bed upwardly through the coal-film ensures rapid carbonization, and a complete release of the gaseous contents of the coal during the gas-making period. The gases are not fixed in the generator, but are taken off at a comparatively low temperature. The feeding apparatus is of advantage, as it ensures a uniform distribution of the coal-film; while the spreader is protected from the heat during the generation of the gas. The connecting of the outlet-valve for the second fixer with the closing-valve between this fixer and the condenser ensures the correct operation of these valves, and renders their operation easy.

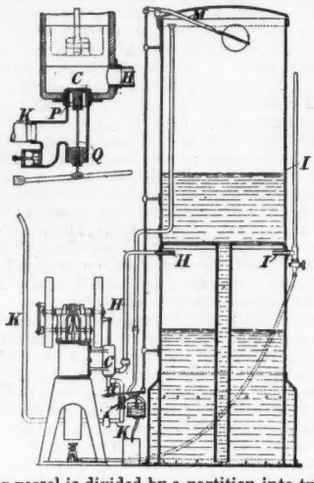
The using of a small portion of the gas passing from the scrubber for

cooling the connecting pipes from the fixer prevents the formation of tar in these pipes.

Production of Compressed Gas.—Knapp, W., and Steilberg, R., of Hamburg. No. 16,618; Aug. 16, 1899.

This invention has for its object to prepare compressed gas (principally intended for lighting purposes) by mixing illuminating gas with air and forcing the mixture into a reservoir loaded by liquid or other weight, and whence the gas can be taken under the maximum pressure for various purposes.

The apparatus shows a front view (partly in section) of the arrangement, and an enlarged view of the pump in cross section.



The generating vessel is divided by a partition into two compartments, the upper one connected with the lower by a pipe extending downwards from the partition nearly to the bottom of the lower compartment. This latter is filled with glycerine or other suitable liquid, which, when at rest, attains the same level in the central pipe as in the lower compartment. Above the level of the liquid in this compartment is the pipe H for the admission of the gas; while the pipe I for drawing off the gas is at about the same level. In the present case, the gas is drawn out of the pipe K and forced into H by means of the pump C, which is driven (say) by a hot-air motor. In consequence of the uninterrupted admission of gas into the lower compartment, the liquid therein is forced to ascend through the central pipe into the upper compartment of the vessel A, where it rises in proportion to the increasing volume of gas in the lower one. When the liquid is almost entirely forced out of the lower chamber, and the upper compartment is therefore almost filled with liquid, the pump is automatically stopped by means of a lever M connected with a ball-float, which lever closes the suction-valve by acting as shown on the enlarged sketch.

The valve P is provided with a central cylindrical bore, in which is inserted the head of the connecting-rod Q. If the ball is lifted by the liquid, the head of the rod is pushed into the boring, whereby the stroke of the valve P is gradually diminished until it comes to a standstill—that is to say, the valve is pushed off its seat so that the pump runs empty. So soon, however, as the volume of gas has decreased or the ball-float descends, the valve P begins to act again; and thus the consumed gas is replaced. For double security, in the event of the automatic cut-off failing to act, a second automatic device, actuated by the overflow of the liquid in the upper compartment, is provided, which closes the suction-pipe of the pump.

APPLICATIONS FOR LETTERS PATENT.

21,175.—Brookes, A. G., "Prepayment meters." A communication from the New Haven Novelty Machine Company. Oct. 24.

21,191.—Mowat, J., "Acetylene gas lamp-lighting torch." Oct. 24.

21,200.—Jackson, J., "Incandescence gas-burners." Oct. 24.

21,297.—Stevenson, G. & F., "Generation and storage of acetylene gas." Oct. 25.

21,338.—Jensen, H., "Gas and liquid meters." Oct. 25.

21,342.—Richardson, F. C., "Compression pumps for exhausting and compressing gases." Oct. 25.

21,349.—Starke, R., "Production of compressed blocks of calcium carbide." Oct. 25.

21,359.—Smith, I. & W., "Fluid pressure-recorders." Oct. 26.

21,360.—Bell, J. D., "Starting gas-engines." Oct. 26.

21,407.—Jacot, L., and Schaller, F., "Generating acetylene." Oct. 26.

21,417.—Beutier, L., and Vernier, C., "Discharging the products of combustion arising from gas-fires." Oct. 26.

21,434.—Brunton, L. B., "Heat-economizing flue-pipe." Oct. 27.

21,457.—Jackson, J., "Street gas-lamps." Oct. 27.

21,558.—Boult, A. J., "Igniting gas." A communication from G. Skaruppe. Oct. 28.

Stokers' Wages at Neath.—The following is from the "Cambrian:" "If the story told by the stokers at the Neath Gas-Works be true, one need not be surprised at the fact that the Corporation are making money out of the undertaking—eighty-four hours per week, and a maximum wage of 32s. 6d., are conditions such as should not be permitted to continue another moment. At Swansea, only 48 hours are worked per week, and the wage is 30s. A simple process of subtraction will show that the Neath stokers work 36 hours for 2s. 6d.—less than a 1d. per hour. The Secretary of the men's Union has had an interview with the Chairman of the Gas Committee and the Manager, and work is to be continued for a fortnight, and in the meantime better conditions of labour are to be arranged."

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Heating of Gas-Retorts.

Sir,—I have no desire whatever to anticipate any discussion that may take place on my paper read before the Midland Association, nor do anything which might tend to reduce the temperature of the tropical time you so kindly foreshadow for me; but I do wish to point out, if you will allow me, that I submitted four propositions—viz.,

(1) That there is no real advantage to be gained in fuel consumption by heating the primary air with so-called waste gases.
(2) That there is no real advantage to be gained in fuel consumption by heating the secondary air with so-called waste gases.
(3) That all the advantages claimed for recuperation can be obtained by generator settings.
(4) That the best method of heating gas-retorts—horizontal or inclined—to-day is by having one producer for several beds, as introduced and adopted by Mr. Carpenter at Vauxhall.

In your notes on the meeting, you reduce these to the following "that, even in small works, one producer for a number of beds is the most efficient and economical system for heating retorts," which does not fairly cover the ground.

Again, you say I seem to renounce my own "offspring." This is not the case. My offspring does not consist of a recuperator only. In my notes, I have endeavoured to show there is wisdom in giving up recuperators generally. This may mean the amputation of a limb to my offspring—nothing more.

Nuneaton, Nov. 1, 1899. Geo. Helps.

[Without any desire to draw Mr. Helps into a discussion, we should like to point out that the words quoted in our editorial note last week are his own, and are to be found in the last paragraph but one of his instructive paper. From their conclusiveness there is no departure. The author "is of the opinion that, even in small works, one producer for a number of beds is the *most efficient and economical system for heating retorts*." If this is so, all other systems of heating retorts must be, in greater or less degree, inferior. That was our only point.—Ed. J.G.L.]

Gas and Water Companies and the Building Law.

A legal correspondent—adverting to the case of the *Uckfield Rural District Council v. Crowborough District Water Company*, referred to last week—points out that neither party engaged in the controversy seems to have noticed a very pertinent provision contained in the Water-Works Clauses Act, 1847. Section XCIII. is in the following terms: "And be it enacted that nothing herein or in the Special Act contained shall be deemed to exempt the undertakers from any Act relating to water-works or any Act for improving the sanitary condition of towns and populous districts which may be passed in the same session of Parliament in which the Special Act is passed or in any future session of Parliament." He adds that Section XLIX. of the Gas-Works Clauses Act is in precisely similar terms, excepting that "gas-works" takes the place of "water-works." Furthermore our correspondent mentions the case of the Gosport Gas Company, in which some years ago the same point was raised and decided by the Queen's Bench Division adversely to the Company.

Winding Up of the British Gas Traction Company, Limited.—In the Chancery Division of the High Court of Justice last Wednesday, before Mr. Justice Wright, a compulsory winding-up order was made against the above-named Company.

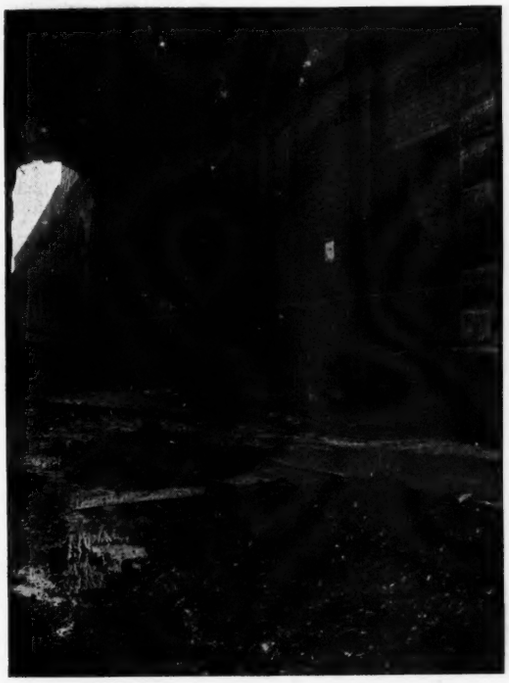
An Italian Gas-Engine Company.—We learn from Italian papers that a company has been formed in Milan for developing the undertaking hitherto carried on by Messrs. E. Garuffa and Co. mainly for the construction of motors, on the Lencauchez and Delamare-Debouteville types, for the utilization of poor gas for the production of motive power. It is stated that a large amount of the necessary capital has been subscribed, and that the issue of shares will take place before the close of the present year, by which time the new works which have been put up will be ready to start.

Stokers' Wages and Holidays at the Rochdale Gas-Works.—At the last meeting of the Rochdale Town Council, the question of the recent concessions made to the gas stokers was brought up by Mr. Hacking, who asked whether the Town Clerk had received a communication thereon from the Gas Workers' Union. The Chairman of the Gas Committee (Alderman Petrie) said a letter to them had been read on the previous evening. Mr. Hacking observed that while the men at the gas-works were gratified at the concessions made to them by the Committee, they felt it a hardship to be deprived of holiday pay, which they had received for the past ten years, simply because some little addition had been made to their wages. Mr. Sharp spoke in a similar strain. He said the concession would only mean £45 per annum extra; and he thought the ratepayers would not grudge this sum in order to pay the men while they went on a well-earned annual holiday. He hoped the Committee would give way on this matter. Alderman Petrie, in reply, said the Committee felt that this ancient system of paying a man when he was on his holidays was somewhat irregular. They considered that it was much better and wiser to pay the men the full value for their labour when at work, and to let such irregularities as paying a man when he was holiday-making sink into oblivion as an old custom. The concessions referred to are an increase of 3d. per shift to the stokers, in addition to the payment of time-and-a-half for the third shift on Sunday already conceded, but payment for the week's holiday allowed annually to permanent stokers is to be discontinued; and an increase of 1s. a week to the general labourers, in addition to the 1s. previously granted, bringing their wages to 23s. per week.

MISCELLANEOUS NEWS.

THE EXPLOSION AT THE MANCHESTER (ROCHDALE ROAD) GAS-WORKS.

In last Tuesday's issue, we published a brief account of the very lamentable explosion which occurred the previous day at the Rochdale Road Gas-Works of the Manchester Corporation, and by which Mr. George Ernest Stevenson, the Manager of the works, and Consulting Gas Engineer to the Corporation, was fatally injured. His head and face were considerably affected; and although he received at the Royal Infirmary all the attention that medical skill could suggest, he succumbed the same afternoon about half-past three—close upon four hours after the explosion occurred. Altogether about a dozen men were more or less injured. Regarding three of the unfortunate sufferers who were admitted as in-patients at the Infirmary, our last information was that two of them (M'Mahon and Richards) were still in a serious condition, and the third (Littler) was improving. Details as to the circumstances surrounding the sad occurrence will be found in the report of the proceedings at the inquest; and the three photo-engravings will give some idea as to the scene of the catastrophe, and the damage effected. The first is a side view of the old meter-house; the archway at the end being under the clock-tower, which was considerably damaged by the explosion and resulting fire, and which for a time was the cause of much apprehension. It was near this spot that Mr. Stevenson was thrown by the force of the explosion, and where most of the workmen were injured. The second illustration (which is somewhat blurred by steam and smoke) shows the interior of the wrecked meter-house, and the third is an exterior view of the ruined roof of the same building. A notice of the life and professional career of Mr. Stevenson, and an editorial reference to the calamity, appear elsewhere.



The Inquest on the Body of Mr. G. E. Stevenson.

The inquiry into the circumstances relating to the death of Mr. Stevenson was opened by Mr. L. J. AITKEN, the Deputy-Coroner for the city, on Thursday.

Mr. T. HUDSON, the Deputy Town Clerk, appeared on behalf the Corporation; and Mr. J. H. ROGERS, Her Majesty's Inspector of Factories, represented the Home Office. Among others present were Mr. Charles Nickson, the Superintendent of the Gas Department, and Mr. Alderman King, the Chairman of the Rochdale Road Station Sub-Committee of the Gas Committee.

Mr. HUDSON, at the commencement of the proceedings, asked leave to say, on behalf of the Manchester Corporation, with what sorrow they had heard of the terrible catastrophe, and how much they sympathized with the family of the late Mr. Stevenson and with the men who had been injured. Mr. Stevenson was a man who was very highly respected; he was an extremely capable gas engineer; and had been President of the Institution of Gas Engineers. His conduct and abilities were such as to inspire perfect confidence in him on the part of the Corporation. He wished to add that the Corporation were desirous of affording every possible assistance in elucidating the matter.

The CORONER remarked that a very valuable life had been lost in a very shocking manner; and he felt sure that all sympathized with Mr. Stevenson's wife and family, and with the relatives of the injured men.

The first witness was

Mr. *Edgar Hewitt*, who identified the body of the deceased as that of his father-in-law. Mr. Stevenson, he said, was 51 years of age last month.

The DEPUTY-CORONER, before proceeding further, with the aid of a plan, explained to the Jury the operation which was being carried out at the works at the time of the explosion. Part of a main pipe, which had been disconnected, was being bricked up; the gas having been stopped a little farther along the pipe with a bag, which was kept in

position by means of a force-pump. The pump appeared to have been suddenly removed, with the result that the bag collapsed, the gas escaped, and an explosion followed. He also intimated that, as nearly all the persons who were concerned were confined to bed, it would be necessary to adjourn the inquest after taking a little evidence.

John F. Jones, a stoker employed at the works, after being cautioned by the Coroner, next gave evidence. He said that on Monday morning, without receiving any instructions to do so, he went to a man named Fletcher, who was engaged on the job, and was in charge of the force-pump. The pump being required in connection with the machines in another part of the works, he took hold of it, and said to Fletcher: "I'll take this away, Jack;" but he could not remember what reply Fletcher made. Nobody ordered him to move the pump; and he made no inquiries as to whether it was being used. When witness took the pump, Fletcher snatched it out of his hands, and made some exclamation. The pump was connected with the gas-bag; but it was impossible to see that it was. He asked Fletcher why he could not have the pump; but he did not remember just what the latter said in reply. Mr. Tooley, the General Foreman, came on the scene, and witness appealed to him as to why he could not have the pump. Mr. Tooley replied that he had better wait until Fletcher had done with it. He did not know that the pump was attached to the bladder, or that the pipe had been cut.

The Coroner: It seems a very slack way of doing work. How long was it after you lifted the pump before the explosion occurred?

Witness: About ten minutes. There was no one near the pump at the time except Fletcher; and the pipe connections were entirely out of sight.

Was not that all the more reason for your being careful? You see if the Jury think you did this thing negligently without making inquiries it may be necessary for you to be sent to take your trial. I do not want to appear to bully a man who has volunteered his evidence; but if you like to tell us anything more, we shall be glad to hear it.—There is nothing more I can tell you.

By the Jury: The pump belonged to the retort-house in which he worked. When he lifted the pump, there appeared to be no strain on it. The pump was laid at the edge of the curbstone; and the hose-pipe attached to it was hanging down the hole, at the bottom of which the connection with the bag was made.

Mr. *G. W. Tooley*, the Resident Foreman at the works, who appeared with his forehead and hands in bandages, stated that he was standing by the side of Mr. Stevenson when the explosion occurred. The force-pump which had been mentioned belonged to the mainlayers; but since gas-engines were brought into use in the retort-house, it had been used for the purpose of removing any water that got into the service-pipes of the gas-engines. He did not see Jones come up; but he saw the altercation between him and Fletcher. There was a tap on the pump, and also a tap on the bladder. In snatching the pump away, Jones carried off both of the taps, and also the neck of the tube; and the bladder thus collapsed.

The Coroner: Would the bladder not offer some resistance when the pump was snatched away?

Witness: No. It is made of canvas, and any sudden snap would make it give way.

Were you aware that Jones had broken the connection?—I was aware he had broken the connection; and I afterwards saw the men trying to blow into the bladder with their mouths through a portion of the neck of the tube that remained.

What did you say to Jones?—I said he had no right to come and interfere, and that he would have to wait. As a matter of fact, Jones had no need for the pump at that time; for it was only eleven o'clock then, and the next charge in the retort-house did not take place till twelve.

Did you apprehend any danger from what Jones did?—Decidedly.

At once?—We knew the danger at once; and we could do nothing to avoid it.

You could have got all the men out of the place, could you not?—It was only two or three minutes between the time of the bladder giving way and the explosion.

If Jones says it was ten minutes that is absurd?—Quite absurd. The flow of gas from a 24-inch main with 2 inches of water pressure behind it is very great.

In further examination, witness said Mr. Stevenson asked him what Jones had been doing; and, on being told, he said "I shall want to see him afterwards." Then the explosion took place. There were no naked lights being used on the job, as the flags had been taken up; and it was possible to see quite well. The gas must have been fired by a flame somewhere; but where it was quite impossible to tell. The light might have been in the clock-tower or in the boiler-house.

By Mr. Hudson: The operation was being conducted in the only possible manner. There were five pipes going into the old meter-house; and this was the fifth that was being disconnected when the explosion occurred. The disconnection of the other four had been accomplished without accident. The gas that rushed out when the bag collapsed came from the main in the street, and not from the works.

By the Jury: It was not possible to turn off the gas, as it was a trunk main; and to have shut off the gas would have meant shutting it off from the whole of the city.

James Prior, a foreman pipelayer, said that at the time of the explosion, he and others were busy bricking up the open end of the main. As soon as the connection of the pump with the bladder ceased, the bladder was blown towards the open end. Three-fourths of the open end had been bricked up; and in another twenty minutes the job would have been completed. He and others did the best they could to blow the bag up again; but the gas overpowered them, and they had to give up the attempt. He could see the bag collapsing through the opening in the brickwork. The explosion occurred in about a minute or a minute and a half at the outside. He managed to escape the results of the explosion by throwing himself flat on the ground. He crawled out after the explosion, and then went back and assisted to get some of the other men out. There was no light in the clock-tower; the gas had not been on there for a month.

Mr. *Tooley* (interposing): I think it was re-lit on Sunday night.

It was decided at this point to adjourn the taking of further evidence; and the Coroner and Jury proceeded to Rochdale Road to view the scene of the explosion. On returning to the Court, the Coroner remarked that, from what they had seen, it was almost impossible for Jones to have removed the pump without seeing that it was attached to something down below.

The Foreman of the Jury said they desired to express their deep sympathy with Mrs. Stevenson in her bereavement. The Coroner joined in this expression of sympathy, and said he would forward it to the family.

The inquest was then adjourned till to-morrow.

OIL GAS ENRICHMENT COMPANY, LIMITED.

The Sixth Annual Meeting of this Company was held in Edinburgh on the 26th ult.—Mr. James Milne in the chair.

The Secretary (Mr. J. Gordon Mason) having read the minutes of the previous meeting, the report and accounts, briefly mentioned in the "Journal" for the 24th ult. (p. 1011), were taken as read.

The Chairman, in the course of his remarks when moving the adoption of the report, referred to the negotiations on foot for the acquisition of another patent—viz., that taken out by Mr. W. Young, of Peebles, and Messrs. S. & T. Glover—and said the agreement would be signed in the course of a few days. The new patent was No. 20,125 of 1896; and it embraced three claims with reference to the manufacture and enrichment of gas, and to the absorption or removal of the naphthalene contained in it.* The process would be of particular value to gas manufacturers in England, where the coal was being carbonized at higher temperatures every year. The result was that they are very much troubled with naphthalene. They also in this way lowered the illuminating power of the gas; but they increased the quantity obtained from the coal. Mr. Young and Mr. Glover found that by using gas from common coal, and, after cooling it, introducing into it gas distilled from cannel coal at a very much lower temperature, it had a double effect. It, to a certain extent, eliminated the naphthalene, which had been the cause of so much trouble; and it also gave a far greater enrichment value than was obtained by distilling the cannel coal at a high temperature. The patentees proposed to the Directors, on very fair terms, that the Company should take up the process, and introduce it to the public. They had already had inquiries from large towns in England in regard to it; and he had little doubt that the Directors would have a very good report to present next year in reference to it. They were still working the oil gas enrichment process at Paisley, and he hoped the shareholders would hear shortly that the plant there had been taken over. It was as satisfactory as possible now.

Mr. G. Harrison seconded the motion, and it was carried.

The retiring Directors and Auditors were then re-elected; and the proceedings closed with a vote of thanks to the Chairman.

SOUTHAMPTON GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Wednesday—Mr. R. C. Hankinson, J.P., presiding.

The report which the Directors presented stated that, during the six months ending June 30, there was an increase of 9,769,400 cubic feet in the quantity of gas sold as compared with the corresponding period of last year, and there was also a substantial rise in the amount realized from the sale of residual products. The sum available for distribution was £8817; and the Directors recommended the payment of maximum dividends (less income-tax), which would absorb £8797.

The Chairman, in moving the adoption of the report, congratulated the shareholders on its favourable character. A satisfactory feature was the increased sale of gas, which was something like 10 million cubic feet in excess of that for the June half of 1898. This represented an increased consumption of 4¾ per cent.; and the additional money received for gas was £1485. As to competition, he had often said they were not at all afraid of the electric light; but it would be bad policy to argue that the light had not affected the sale of gas, particularly in the town proper. He did not, however, know that the town was lighted any better than it used to be. It would be gratifying to the proprietors to learn that the decrease in consumption in the town had been more than compensated for by the increased consumption in the suburbs. Then another gratifying feature was the increase in the amount received for residual products. The receipts for residuals were £8972, which was an advance of nearly £2000 on the corresponding half of last year. The Directors were proposing to raise more capital by the issue of £10,000 further stock. It might appear that they were spending a great deal of money; and so they were. But they were bound to provide houses for the labouring class in substitution of those pulled down for the enlargement of the works; and this alone involved a large outlay. They had also adopted the prepayment meter system, which had caused large expenditure; but the Directors did not regret this, as it was a paying feature of their business. The system was very popular; for already 900 meters had been fixed, and upwards of 300 further applications had been received. The consumption of gas in the day time for cooking and for motive power was likewise extending. There were now 1627 cooking-stoves on hire; this being an increase of 247 in the six months, and not including 800 cookers used with the slot meters. One other point he should like the shareholders to note—that this was the first time, with one exception, for nine years, that they had earned sufficient profit to pay the maximum dividends and debenture interest without having to resort either to undivided profits or to the reserve fund.

Mr. Sampson seconded the motion.

Mr. Arthur Paddon commended the Directors for the modest character of the report, and said the position of the Company reflected more credit on the administration than the Board had taken to themselves. They had made sufficient profit for the dividend without drawing on the reserve fund; and in this connection it might be pointed out that the charge in Southampton was 6d. less than the price of one of the great Metropolitan Companies, who also had not taken from their undivided profits, but had

* The specification of this patent was given in the "Journal" for Sept. 14, 1897, p. 588.

made up the dividends by raising the price, which had not been done in Southampton.

The motion was carried.

The dividends recommended were also declared; and an expression of the appreciation of the shareholders of the services rendered to the Company by the Chairman and Directors and staff concluded the proceedings.

COLONIAL GAS ASSOCIATION, LIMITED.

The Annual General Meeting of this Company was held last Tuesday, at the London Offices, Suffolk House, Laurence Pountney Hill, E.C.—Mr. SAMUEL SPENCER presiding.

The SECRETARY (Mr. A. J. Kingdon) read the notice convening the meeting; and the Directors' report and the accounts, the principal points of which were published in the "JOURNAL" for the 24th ult., were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said the Directors had much pleasure in being able to state that the improvement in the prospects of the Association—alluded to with some confidence during the past two years—had been realized; and they had the fullest reason to believe that it would now continue, and bring them gradually back to the prosperity of a few years ago. It was most gratifying to learn that the Colony was improving in its trade in all branches—particularly in that of wool. Of course, the Association were feeling the benefit of this revival of prosperity at their various stations (which now numbered twelve); and, with one or two exceptions, they had had satisfactory increases at all of them. In one of his communications, their Managing-Director in Australia (Mr. George Swinburne) supported these views, and said he was "pleased to say business is looking brighter all round, and that the improving returns for the past half year are being steadily maintained." Mr. Swinburne had, as usual, sent a very full and interesting report, which was open at any time to the inspection of the shareholders. He (the Chairman) did not think it was necessary, after what he had already said, to make any lengthy or detailed statement regarding the balance-sheet, as it so clearly set forth their position, which, on this occasion, was particularly satisfactory. As would perhaps have been noticed, the increase during the past year exceeded 11 per cent.; and the net profit was £336 above that of the previous year. Consequently, it was the best year they had had since 1893; and the increase would have been considerably larger had it not been for the exceptional circumstance of changes in the management of some of the works at a distance. There was one point in connection with the present balance-sheet he should like to mention; and it was that the retort-setting account had been written off. He had no doubt the shareholders had also noticed that the Directors had appointed Mr. George Swinburne as Managing-Director in Australia, in place of Mr. John Coates. The Board considered the change would materially strengthen the position of the Association in the Colonies, and believed it would meet with the approval of the shareholders. Mr. Coates had been in England for some time during the past summer; and the Directors had had the benefit of his services at several of their meetings. They were pleased to say he had consented to act as an ordinary Director, and so they would continue to have the benefit of his advice. Since the balance-sheet was closed, the Board had, acting upon the suggestion of their colleagues in Melbourne, sold part of the shares the Association held in the Charters Towers Gas Company; and he was pleased to report that a good profit was realized, which had been carried to the reserve fund, and would appear in the current year's accounts. With regard to the Geraldton Gas-Works, in which the Association had held two-thirds interest, they had, during the past three months, acquired the remaining third share; the purchase having been effected by an issue of fully-paid shares. The Directors were very pleased to have secured the entire control of these works; and they considered the transaction a satisfactory one for the Association. Concerning the future, he thought they might look forward with every hope to a year of prosperity; and he was sanguine enough to believe they would increase the dividend in the current year, and, he hoped, for many years to come. There was one other matter he wished to refer to in conclusion. It had been the desire of the Board from the beginning to get a Stock Exchange quotation for the shares; and, as they were only about 1000 shares short of the issue required, it had occurred to him, and he was confident, that, if the largest shareholders could be induced to increase their holdings by about 7 per cent. (with, say, 5s. or 10s. paid up), a quotation would be granted—thereby making the shares much more saleable. If this met with the views of the shareholders present, steps would be taken to bring about this desirable result.

Mr. W. C. PARKINSON seconded the motion; remarking that it was very gratifying their anticipations had been realized—though perhaps not to the full, but still very largely. It must be remembered that their works were small, and very wide apart; and, to his mind, it reflected very great credit on the management of Mr. Swinburne that they had been so economically conducted as they had been. He thought the shareholders might look forward to further increased prosperity.

Mr. JAMES WATSON asked why the bonus shares received from the Charters Towers Gas Company should be placed to the reserve fund. For three years they were without any dividend on this investment; and the shares were afterwards given to the Association to make up for the three years' loss.

The CHAIRMAN replied that, after careful consideration, the Board had decided to carry the profit of the sale to the reserve fund, which would add to the stability of the Association, and assist in maintaining the dividend. In this way the shareholders would be benefited. Since the balance-sheet was published, they had disposed of a part of the shares at a profit. He himself would like to divide a little more; but it was not wise to do so. In the first years of the Association, the Directors paid a dividend of 6 or 7 per cent.; but if they had kept down to (say) 5 per cent., they would have been able to accumulate a good reserve fund, which would have been available for equalization in those years when they could only pay something like 3 per cent. He did not intend, if it could possibly be avoided, to go back to those days again. He thought they would be able to go along steadily now, and give an increasing dividend—anyway they would do their best to maintain it.

Mr. W. H. RICHARDSON inquired the price at which the 1000 shares referred to by the Chairman would be issued.

The CHAIRMAN answered at par. It had struck him that perhaps they might issue them as 5 per cent. preference shares; and if the shareholders would now take up two thousand of the shares with only 2s. 6d. paid up, they would then comply with the Stock Exchange requirements. Another advantage would be that, if at any time they wished to apply to their bankers for a loan, they would have this issue as a security. But it was only a suggestion at present. Replying to Mr. W. Chaffer, he added that they were not requiring money for capital purposes.

Mr. R. H. DYER did not see that any great benefit would accrue from a Stock Exchange quotation, though he admitted that perhaps the fact that this was a foreign and not an English Company would make a difference. He heartily approved of the policy of the Board in instituting a reserve fund; and he advised them not to increase the dividend until they were positive they could maintain it. The capital of the Association was large; but Mr. Parkinson once told him, in reply to a question, that in their works they had value for their money. In his opinion, they should devote themselves to fully developing their present property before extending their operations in other directions.

The CHAIRMAN assured the shareholders that this was the intention of the Board. The works were much in excess of present requirements and they were doing their utmost in the way of developing business.

The motion was carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. A. GODWIN-HAMMACK, a dividend at the rate of 4 per cent. per annum, free of income-tax, was declared for the second half of the year.

The retiring Directors (Messrs. John Coates and A. Godwin-Hammack) and the Auditors (Messrs. Lass, Wood, and Drew) were unanimously re-elected.

The services of Mr. G. Swinburne, the Australian Committee, and the Chairman and Directors and staff were heartily acknowledged; and the proceedings terminated.

THE PROPOSED REDUCTION IN THE PRICE OF GAS AT BLACKPOOL.

Rejection of the Gas Committee's Resolution.

At the Meeting of the Blackpool Town Council last Tuesday—the MAYOR (Alderman Heap) presiding—the resolution passed by the Gas Committee to reduce the price of gas from 2s. 4d. to 2s 2d. per 1000 cubic feet, and increase the quantity allowed consumers on the prepayment system from 25 to 33 cubic feet for 1d., came up for consideration. On the motion to confirm the minutes of the Committee,

Mr. TOMLINSON moved, as an amendment, that the portion of the resolution dealing with the reduction in the price of gas should be referred back. He said he failed to find any justification for taking so serious a step in view of the advancing price of coal, and the condition of the commercial world generally. When they were considering the estimates for the current year, their Gas Engineer (Mr. J. Chew) said a bulge of £3000 would be made into the gas profits if they were to enter into their contracts at that date, owing to the vacillating state of the markets; and he (Mr. Tomlinson) contended that a further bulge of from £2000 to £2500 would be made if the Council sanctioned the reduction. The argument was used that the residual products would sufficiently make up the leeway the 2d. reduction would leave on the gas profits. But in order to make up the leeway, they would have to strip £600 from the profits; and it was bad finance to take money from one department and add it to another. He thought it would be sounder finance to go on as at present; and if the department had any surplus, they could help them to apply the money to municipal purposes, which would be to the good of the town generally.

Alderman FISH, in seconding the amendment, said he thought it hardly a fair thing, after the Corporation had estimated the approximate amount the Gas Manager ought to make, to put him in a different position from that in which he stood when the estimates were prepared. The question might come forward next year.

Mr. CARTLEDGE cited a number of large consumers whose contributions to the gas profits were much less than the amounts they received in the way of relief of the rates—the total difference being about £527. He remarked that it had been said that they should continue the present prices and keep the rates down, so as to induce people to take up their residence in Blackpool. This meant that they should increase the demand for house and shop property, and so compete against themselves, which was unfair. They ought instead to look after those who, having toiled day and night to make Blackpool a prosperous place, had nothing left after paying rent and rates. He contended that the reduction was reasonable and just, and would not do injury to anyone.

Mr. REVILL said if the gas undertaking had been a failure, like some of the departments of the Corporation, the ratepayers would have had to "pay the piper" to keep the works going. On the other hand, it had been a financial success, and they had been assured of £10,000 as profits on the year's working. The price of coal had gone up; but the residual products had also increased in value. It was the majority they had to consider, and not the few. If they would take their gas bills and their rates for the past twelve months and work them out, they would find that, even if the rates went up a little, by a reduction of 2d. per 1000 cubic feet they would really be money in pocket.

Mr. HARTLEY stated that last March Mr. Chew recommended the Gas Committee to defer the question until they had received the estimates for coal, &c. They then found that these had advanced £3000; and therefore it was decided to wait for some time in order to ascertain what the gas-works would make. They were now assured by Mr. Chew that they were perfectly justified in recommending the reduction. He thought they ought to consider the indirect taxation put upon gas consumers.

Mr. BROWN, in supporting the minutes, said that 2½ million cubic feet more gas had been consumed during the past six months than in the corresponding period of the previous year. The price of gas in Blackpool was less than the average of other towns in England. In Mr. Chew they had one of the most efficient gas engineers in the country. He looked after every detail as though the gas-works belonged to himself; and the

ratepayers were fortunate in having a man of his ability. In addition to paying the interest and sinking fund, the gas-works contributed 7 per cent. towards the reduction of the rates. The consumers were entitled to the reduction; and he objected to the Gas Department being made the scapegoat for keeping down the rates.

Alderman WARD was opposed to the reduction, on the ground that the gas was cheap enough for lighting. He said there was no general complaint about it being too dear; and the only reduction should be made to lodging-house keepers who used it for cooking purposes. He thought the working men ought to have the benefit; and he contended that the price of gas used by stoves should be reduced 6d. per 1000 cubic feet.

The MAYOR said he had made up his mind not to support the resolution. He was not going to blame the Gas Committee; for they were evidently jealous of their concern, and he had no objection to that jealousy. Mr. Chew, however, had the idea that if he lowered the price of gas it would affect the electricity works. (No.) That was the general feeling throughout; and it required the strong hand of the Corporation to intervene between the jealousy of the two departments. They had not to look at the matter as a gas or electricity supply business, but to consider how it would affect the town as a whole. If it would affect the town detrimentally, they ought not to have the reduction. He felt certain that to reduce the price of gas below 2s. 4d. would be folly. If it was right for the town, let them do it; but if it was wrong, let them have no hesitation in throwing Mr. Chew and his Committee over. They had a great deal to do in other ways; and, in his opinion, it would pay them far better as a town to keep the gas at 2s. 4d., which was a reasonable price, than to have their rates considerably higher. Mr. Chew estimated that he was going to draw £64,000 for the current year; and that morning he proposed to do away with about £4000. That meant that this sum would have to be laid on the rates in order to put them in the same position as before. He had estimated that they would require a 3d. rate to counteract the 2d. reduction in the price of gas. The proposal made that day did not touch the proper spot. If he considered his own business, he would defend the reduction; for he paid something like £200 a year for gas. If he was suffering and the town was gaining, then he was willing to make the sacrifice. His Worship cited a number of large towns where the price charged for gas ranged from 2s. 2d. up to 3s. 2d., and the rates ranged from 5s. 1d. up to 8s. 8d. in the pound, against 4s. 9d. at Blackpool, and said it would be a bad look-out for the town if the rates ever rose to such figures as these.

Mr. HOLDEN said he was in favour of supporting the minutes when he entered the Council Chamber; but, after the Mayor's explanation, he should vote for the amendment.

Mr. HOWARTH also thought they could not have had better evidence than that given by the Mayor.

Mr. BATTERSBY, the Chairman of the Gas Committee, having briefly replied,

The amendment was put, and carried by 24 votes to 13.

Mr. MORGAN then moved that the latter part of the minute, relating to the prepayment meter consumers being supplied at the rate of 33 cubic feet for 1d., be also referred back, in order that the Committee might consider the advisability of reducing the price of gas to the users of gas-stoves.

Mr. ASH seconded the motion.

Mr. BATTERSBY pointed out that it would interfere with the meters.

The motion was carried; and the Council proceeded with other business.

ELECTRIC LIGHTING NOTES.

The Court of Common Council have decided to inform the City of London Electric Lighting Company that their means of testing the public and private supply are not satisfactory.

The Liversedge District Council on Monday last week decided to apply to the Board of Trade for a Provisional Order to authorize them to supply electricity for public and private purposes within their area.

Colonel W. R. Slacke held a public inquiry at Heckmondwike last Thursday respecting an application by the District Council for sanction to the appropriation of certain land vested in the Council for purposes of electric lighting, and for the borrowing of £14,000 for carrying out a scheme.

The Salford Town Council yesterday week accepted a tender for the supply of electrical plant to the Strawberry Road station for the sum of £15,200. An application was ordered to be made to the Local Government Board for power to borrow the money, together with a sum of £750 for a battery sub-station and offices, and £72,000 for eight sets of steam dynamos required for the new low-tension generating station.

The Association of Municipal Corporations have again resolved to organize opposition to any Bills which may be promoted next year to grant powers to companies to compete in the area of public authorities which have already established electrical undertakings, or are in course of doing so. Apparently the opposition is mainly directed against the projected re-introduction of the General Powers Distributing Bill, the Lancashire Electric Power Bill, and the South Lancashire and Cheshire Electricity Bill, which propose the erection of immense electric light and power stations for the supply of current over large areas.

The Exmouth District Council are still of opinion that it is their duty to go in for the electric light. Last week they had a meeting with Mr. R. Hammond, who is advising them. He told them that the electric lighting would be a success. The capital cost would be £16,000. With 5000 lights at 3d. per unit, they would get a revenue of £2450; and putting the working expenses at £1250, they would have a gross profit of £1200. The net surplus, after deducting £960 for interest and sinking fund, would be £240. The Council were very pleased with this prospect, as was only natural; and they separated with the opinion that they ought to go in for electric lighting at once.

At the meeting of the Blackpool Town Council last Tuesday, Mr. Cocker drew attention to the General Purposes Committee's minutes, with regard to an application to be made to the Local Government Board to borrow £42,515 for extensions of the Corporation electricity works. He said that, while objecting to the proposal, he would not move any amendment, but would vote on principle against spending any more money for either the electricity or the gas works, or the refuse destructor. They had in Mr. Quin a very clever young man, he granted, as Manager of the works; and he was backed up perhaps by the experts he had on his Committee. But neither he nor anyone else would borrow such a sum as the one proposed without further advice. They had had clever managers before; but when they had a new one, he upset everything done by the others. This might be the case again; and then they would have to go to more expense. The minutes were passed.

A Local Government Board inquiry has been held by Mr. G. W. Willcocks with regard to an application by the Great Yarmouth Corporation for a further loan of £27,000 for electric lighting plant. It was pointed out that the electric installation was commenced in 1894; and there had been considerable extensions since that time. The financial result had been that all the expenses of running and interest had been met, and £3524 of the loan had been repaid. The total capital expended on the works was £38,615; and the Corporation had received sanction to borrow £40,000—the balance being kept in reserve to meet the requirements of additional customers. With regard to the current year, the sum of £77 had been earned in the two worst quarters; and it was estimated that an amount of £500 would be earned by the undertaking during the coming year. The reason for the application was the immediate need of extra plant for public and private lighting in Yarmouth and Gorleston, and for the supply of current for the trams.

The Shipley District Council have received from Mr. Robert C. Quin a report on the question of an electricity supply for the district. He sets out a system of supply capable of dealing with tramways, street lighting, and pumping sewage; the pumping current being treated as an "out-of-balance" current. Mr. Quin stated that as the gas supply did not belong to the Council, and as electricity for lighting or other purposes, where a lengthened use was made of it, was more economical than gas, he would strongly recommend that wherever distributing mains were laid the streets should be electrically lighted. Assuming an average daily use of ten hours for each lamp, the cost for current to 34 incandescent lamp-standards of 32 actual candle power, and four arc lamps for the Market Place, would be £1000 per annum. He thought it would be well to fix the cost of current for street lighting at 2d. per unit. This would leave a slight margin of profit to the Electricity Department, and would be equal, light for light, with gas (under Welsbach incandescent conditions) at approximately 2s. per 1000 cubic feet. The charge to the public he recommended should be 7d. for the first hour's use, on a six months' basis; and 2d. per unit for any further units consumed in the same period. Mr. Quin's estimate of costs amounted to £14,476, made up of the following items: Generating station £1700, mains £9000, street lighting £264, 100 services to consumers at £10 each £1000, contingencies (10 per cent.) £1196, and engineering and other expenses (10 per cent.) £1316. The Council have not yet publicly discussed Mr. Quin's report; so that we do not know whether its sanguine character will suffice to embolden the councillors to risk the ratepayers' money in such a venture.

Mr. H. H. Law, one of the Inspectors of the Local Government Board, held an inquiry at Dudley last Tuesday in regard to an application by the Corporation to borrow £33,000 for electric lighting purposes. The Town Clerk (Mr. H. C. Brettell) said the Order was obtained in 1897, and in 1898 the Council opposed the application of the British Electric Traction Company for powers to work the Dudley and Stourbridge Tramway (which they had purchased) and other light railways they proposed to start in Dudley. The Board of Trade intervened; and an arrangement was come to whereby the Traction Company were to take from the Corporation the whole of the current they required for working the tramways within the borough, and to fulfil the engagement the Corporation had entered into to erect a temporary generating station. The present loan, therefore, was for completing the equipment of the installation to supply the tramways and the electric lighting. The system had been approved by the Board of Trade. Mr. R. Wilson, the Consulting Electrical Engineer to the Corporation, having described the compulsory area, the Town Clerk went on to say that applications for electric light had been received from two chapels, two works, and innumerable shopkeepers and householders. No canvass had been made; but there was every justification for the Council going on with the scheme. At the generating station, which would be practically built over the temporary station, there would be three generators capable of providing ample current for all purposes. Mr. F. W. Cook, a member of the Town Council, said there was an opinion that the loan was larger than the demand for the first installation warranted. The largest customer for current would be the Tramway Company, and they would only take 5000 units; whereas they would have provision for supplying 5 million units. Only a small number of manufacturers were likely to take the current, and no proper canvass had been made to ascertain the demand. There was no opposition to the laying down of electric lighting plant; but it was a question whether the installation was not larger than was warranted. The Inspector pointed out that the total installation would supply 20,000 8-candle lamps, and this was for lighting the streets, supplying private consumers, and any motive power other than that furnished for the tramways. Mr. Cook said he did not profess to speak as an expert; whereupon the Inspector remarked that he had a perfect right to raise his point.

Explosion at the Nelson Gas-Works.—On Friday morning, about 6.30, great alarm was occasioned in the vicinity of the Nelson Corporation Gas-Works at Brierfield by an explosion and the almost simultaneous outburst of fire at the works. Information was immediately sent to the Corporation fire-brigade station, and fortunately the firemen succeeded in subduing the flames before any damage was done, except to the building in which the fire originated. It was not until after the brigades had ceased working, however, and all danger was apparently removed, that the workpeople who, on the occurrence of the explosion, had hurriedly left their employment in an adjoining cotton-weaving shed could be induced to return to work. The exhauster-house, where the accident occurred, was completely wrecked; the roof being blown off and the beams and stones carried in all directions and to great distances. Happily no workmen were in the building at the time of the explosion. It is supposed that leakage of gas occurred through the tank of the station governor not containing sufficient water, and so allowing the gas to escape into the exhauster-house, where a light was burning. All the gas consumed in Nelson is manufactured at Brierfield and pumped through to the works at Nelson; but the explosion did not cause any interruption of the lighting of the borough.

THE LAW RELATING TO UNDERGROUND WATER.

Lecture by Lord Robert Cecil, Q.C.

The above was the subject of a lecture by Lord Robert Cecil, Q.C., to the Solicitors' Managing Clerks Association, in the Inner Temple Hall, on Wednesday last. The lecture is of particular interest, as it brings within reasonable compass, and in useful form, the various decisions bearing upon the question of underground water, with comments by his Lordship, to whom we are indebted for the use of his manuscript.

In the introductory portion of his lecture, Lord Robert pointed out how progress and prosperity had changed the conditions of our underground water supply during the last few decades—how the working of mines has affected the supply, and how as the population has increased the demand for water has increased. Indeed, he remarked, the demand for water has increased out of all proportion to the increase of population. We have become cleaner than we were; and main drainage, too, has advanced all over the country. Accompanying this increase in the demand for water has come an insistence on its greater purity. Towns which fifty years since were content to take their supply from more or less polluted rivers have sought sources of undoubted purity. In this search, deep wells have been sunk by water authorities all over the country, and large quantities of water have been pumped therefrom. London itself is supplied by the water companies with millions of gallons a day drawn from deep wells in the chalk; and this is but one of many instances. Such drafts cannot be made without affecting the water supply of others. Not only have neighbouring wells been dried, but even the natural overflow by springs and streams has been diminished, to the injury and discontent of millowners and other riparian proprietors. It is hard for a landowner to lose the water in his well; it is harder for the countryside to see their streams gradually sink and vanish away. Englishmen being what they are have not submitted without a struggle to these losses; and a plentiful crop of litigation has resulted. It is, his Lordship philosophically remarked, by such things that lawyers live, and that the common law is evolved.

Tracing its evolution in this particular direction, he said that one of the earliest cases in which the question of the right to underground water came up was that of *Prickman v. Tripp* in 1693. The plaintiff here was the owner of a well from which the water rose and overflowed into a stream. The defendant dug a cistern in such a position as to prevent the underground water flowing into the well. No decision was given on the legality of the defendant's act. All that can be said is that, in the discussion which turned on questions of pleading, it seems to have been assumed that the plaintiff was legally entitled to redress. Next came the case of *Balston v. Bensted* in 1808. Bensted had sunk a quarry, by which it was alleged that he cut off part of the supply to Balston's spring. At the trial, the main controversy was as to the facts. But early in the case, Lord Ellenborough stated that there could be no doubt that twenty years' exclusive enjoyment of water in any particular manner afforded a conclusive presumption of right in the party so enjoying it. By this wide declaration, the learned Judge shut the door in the face of any contention that the law applying to water in surface streams did not apply to water percolating through the soil; and, as will be seen, his opinion can no longer be regarded as law. For 35 years there was no further decision on the question, though in 1839 it was discussed in Chancery in the case of *Hammond v. Hall*.

In 1843, the case of *Acton v. Blundell* was decided, which may be said to be the source of the modern legal doctrine on the subject of this lecture. It was a case arising out of the growth of the mining industry. The predecessor of Acton sunk a well in 1821. Blundell, between 1830 and 1840, commenced mining operations within ¼ to ¾ mile from the well. The result was that, though Acton deepened the well more than once, in 1840 it was completely dried, and litigation ensued. The question came before the Court of Exchequer Chamber whether on these facts Acton had any right of action against Blundell; and they held he had not. Two lines of reasoning weighed with the Court. It was felt there was no true analogy between water percolating underground and water flowing in watercourses or rivers on the surface of the earth. The law as to rivers and streams, they said, was well established. Each proprietor of land over which a stream flowed had a right to use the stream as he pleased, provided that such use was not inconsistent with a similar right in the proprietors of the land above or below. In other words, such a proprietor has no complete ownership of the water in the stream. He may do nothing which will diminish the quantity or injure the quality of the water which would otherwise naturally descend, nor may he throw back, or refuse to allow to pass in its accustomed channel, the water which ordinarily comes down to him from above. On the other hand, each proprietor has the correlative right to receive the water from the land above, and to pass it on in its usual channel over the land below. The Court appear to have considered that each landowner with a stream on his property had a right almost in the nature of an easement over all the land above and below, compelling the proprietors to allow the stream to flow in its natural course. When the ground and origin of these rights to surface streams are considered, the distinction between them and underground water was, so the Court thought, clear enough. Lord Robert quoted, *in extenso*, the first reason given by the Court for their decision. Put shortly, they said the right of a riparian owner to the flow of a surface stream depended upon its notorious and long-continued course, and that, therefore, the right did not extend to water percolating underground. The Court held that, if the plaintiff were to succeed, the consequences would be very inconvenient. But, remarked the lecturer, it may perhaps be doubted whether the balance of convenience is so decidedly in favour of allowing each man to pump what water he can from his own land. Without, however, discussing the point at this stage, he cited the concluding portion of the decision of the Court: "It is scarcely necessary to say that we intimate no opinion whatever as to what might be the rule of law, if there had been an uninterrupted user of the right—*i.e.*, to draw water from a well—for more than the last twenty years; but, confining ourselves strictly to the facts here stated, we think the present case is not to be governed by the law which applies to rivers and flowing streams, but that it rather falls within that principle which gives to the owner of the soil all that lies beneath its surface—that the land immediately below is his property whether it is solid rock or porous ground, or venous earth, or part soil, part water; that the person who owns the surface may dig therein, and apply all that is there found to his own purposes, at his free will and pleasure; and that if, in the exercise of such right, he intercepts or drains off the water collected from underground springs in his neighbour's well, this inconvenience to his neighbour falls within the description of *damnum absque injuria*, which cannot become the ground of an action."

The next case of importance was *Dickinson v. Grand Junction Canal Company*, decided in 1852. But its authority was much shaken, and in part destroyed, by the well-known decision in *Chasemore v. Richards*, which was decided in 1857 upon a special case stated by an arbitrator. The plaintiff was a millowner on the River Wandle, who had enjoyed his mill for more than twenty years; and the defendant represented the Croydon Local Board. In 1851, the Board sunk a large well for the water supply of their district, and pumped considerable quantities of water therefrom. The arbitrator found that the effect of the pumping was to intercept water which would otherwise have found its way into the Wandle above the plaintiff's mill by underground runlets, ill-defined, and shifting in their nature. He also found that no water which had once got into the bed of the Wandle afterwards flowed back into the well. Lastly, he found that the defendants acted without malice, but with reasonable means of knowledge of the results of their action. On these facts the Court of Exchequer gave judgment for the defendants, and the Court of Exchequer Chamber affirmed that judgment. The case was then carried to the House of Lords; and the Judges were summoned. They (by the mouth of Mr. Justice Wightman) unanimously advised the House to affirm the Exchequer Chamber, and dismiss the appeal. They thought that the principles which apply to flowing water in streams or rivers, the right to the flow of which is incident to the property through which it passes, were wholly inapplicable to water percolating through underground strata which has no certain course, no defined limits, but which oozes through the soil in every direction in which the rain penetrates. They pointed out the difficulties that would beset the establishment of a right to percolating water. When would such a right commence? Would a man be prevented from catching and storing the rain falling on his roof which would otherwise have gone to feed his neighbour's stream? How far would it extend? Some deep wells draw their supplies from great distances. Would all the proprietors within these distances be entitled to bring actions? The authorities, with the exceptions of *Balston v. Bensted* and *Dickinson v. Grand Junction Canal Company* were, they thought, unfavourable to the plaintiff's claim; and they particularly relied upon the cases of *Rawstron v. Taylor* and *Broadbent v. Ramsbotham*, which show that a proprietor may appropriate water oozing on the surface of the ground unless it is flowing in a definite channel. Nor did the fact that the plaintiff had used the water for his mill for more than twenty years make any difference in their view. The right to water in a stream existed *jure naturæ*—as part of the natural incidents of the soil, and had nothing to do with prescription. This must *à fortiori* apply to any right to subterranean water independent of any prescriptive user. They therefore concluded that such a right as that claimed by the plaintiff was so indefinite and unlimited, that, unsupported as it was by any weight of authority, it could not be well founded.

It will be seen that in this opinion the Judges did not entirely follow the judgment of *Acton v. Blundell*. All the doctrine that the right to the flow of surface streams was based on long-continued and notorious enjoyment was abandoned. With it necessarily went the reasoning against the right to underground water founded upon its difference in this respect from surface streams. So, too, the doubt expressed in *Acton v. Blundell* as to the effect of twenty years user of underground water disappeared. The opinion of the Judges in *Chasemore v. Richards* seems to rest, apart from authority, upon the short ground indicated at the end of the judgment in *Acton v. Blundell*, that the right to underground water is one of the incidents of the ownership of the surface, and that it is absolute, and cannot be limited by the results to neighbouring proprietors of its user or consumption. To limit it in such a way would be to interfere with the rights of ownership, and would besides be very undesirable from a practical point of view. No opinion was expressed by the Judges whether the fact that the underground water was flowing in a well-defined and known course made any difference. But the majority of the House of Lords, while heartily concurring with the Judges in their conclusions, intimated that the decision would have been different if the subterranean water had been flowing in a known and definite channel. The lecturer does not quite appreciate why their Lordships thought it was necessary that the underground channel should be known. That it must be defined may be thought necessary to avoid the difficulties as to the nature and extent of the right to it pointed out by Mr. Justice Wightman. But since it is admitted that the right to flowing water is *jure naturæ* an incident of the ownership of the land upon or through which it flows, the question of whether or not the owner knows of its existence seems immaterial.

To complete the account of *Chasemore v. Richards*, the lecturer dwelt at some length on the views of Lord Wensleydale, who did not quite agree with the other Law Lords. Without disturbing the continuity of the lecture, we may pass over this portion with a reference to one point. The rule suggested by Lord Wensleydale has been adopted in New Hampshire (U.S.A.) in several decisions—viz., that a landowner's rights to obstruct or divert oozing or percolating water is limited to such a quantity of water as is necessary for the reasonable use of his own land. It would, Lord Cecil remarked, be interesting to know what definition, if any, has been given of "reasonable use," and whether in New Hampshire they suffer from all the inconveniences which the majority of English Judges have thought would result from the adoption of any rule of law restricting landowners in the free use of the water percolating through their land. To these questions the lecturer has not been fortunate enough to find an answer.

Whatever may be thought of the expediency of the rule laid down in *Chasemore v. Richards*, it is now well established both here and in the United States, other than New Hampshire. It remains to be seen how it has worked out in detail by subsequent decisions. In 1860, the *New River Company v. Johnson* was decided. The Company, for the purposes of their undertaking, had made sewers, and had thereby caused the defendant's well to be dried up. Johnson sought compensation under the Water-Works Clauses Act as being damaged by the Company's works;

and the matter came, by special case, before the Court of Queen's Bench. It was held that damage to be the subject of compensation must be damage arising from an act which, but for the statutory powers of the Company, would have been actionable, and that Johnson's loss did not fall within this description. Johnson complained not only that underground water coming to his well had been intercepted, but also that water already in the well had been drawn off. As far as his claim was based on the intercepting of the water, the case was directly governed by the decision in *Chasemore v. Richards*. And the Court held that the principle of this decision applied also to loss occasioned by the draining of water in the well. This last proposition seems, nevertheless, to be an extension of *Chasemore v. Richards*. It will be remembered that in the latter case no question arose as to the effect of abstracting water which had actually reached, and become part of, the River Wandle, which would have been the true analogy to the water in Johnson's well. Indeed, so far as this part of the decision in Johnson's case is concerned, later decisions make it doubtful if it would now be supported. A similar question arose in 1863 in the case of *Regina v. Metropolitan Board of Works*. There sewerage operations had caused a rivulet and artificial pond to dry up; and compensation was claimed. The Court decided that the claim was not sustainable. But in this case the injury caused was not by drawing off water which had reached the rivulet and pond, but by intercepting water which would otherwise have got there.

Next in order of date came the case of the *Grand Junction Canal Company v. Shugar*, in 1871. Shugar by a drain had drawn off, through subterranean channels, water from the Silk Mill pond, which was a watercourse on the surface of the ground. The plaintiffs had a legal interest in the flow of this watercourse; and they thereupon brought an action. An injunction was refused by Lord Romilly. On appeal, the learned Judge's decision was reversed; and Lord Hatherley, in giving judgment, laid it down that, if the underground water cannot be got at without touching the water in a defined channel, it cannot be got at all. This case seems of great importance. If it be law, the doctrine in *Chasemore v. Richards* is limited, so that although it is lawful to intercept underground water flowing into a surface stream, yet water once in an overground channel cannot be directly or indirectly withdrawn by the underground operations of a neighbouring proprietor. "I say, 'if it be law,'" said the lecturer, because some of the observations of Lord Penzance in 1873, in the case of *Baliacorkish Company v. Harrison* seem difficult to reconcile with it. This was a case of mining operations, whereby a well was dried. Lord Penzance, in giving the decision of the Judicial Committee of the Privy Council, made the following statement: "The disturbance or removal of the soil in a man's own land, though it is the means (by process of natural percolation) of drying up his neighbour's spring or well, does not constitute the invasion of a legal right, and will not sustain an action. And, further, it makes no difference whether the damage arises by the water percolating away, so that it ceases to flow along channels through which it previously found its way to the spring or well, or whether, having found its way to the spring or well, it ceases to be retained there." The only way in which this statement of the law can be reconciled with the doctrine in Shugar's case is by assuming that there is a difference in this respect between the rules of law applicable to running and stagnant water on the surface of the ground. Lord Hatherley lays it down that water once in a stream cannot be taken from it by the underground operations of a neighbouring proprietor. Lord Penzance thinks that a landowner cannot be prevented from excavating land, even though the result of his operation is to drain water which has already reached his neighbour's well, or even his neighbour's spring. The distinction between a stream and a well seems somewhat arbitrary; between a stream and a spring no distinction seems possible.

It will be remembered that, in *Chasemore v. Richards*, the House of Lords thought that the principles applied to streams and rivers above the ground would equally govern conflicting interests in water flowing underground in a known and definite channel. No case has been decided in England (so far as Lord Cecil knows) which would be of assistance in arriving at the exact meaning to be attached to those words, "known and definite channel." In Ireland, however, they have been discussed in two cases. In *Ewart v. Belfast Guardians*, in 1882, defendants were alleged to have cut off by pumping an underground stream issuing and flowing through the plaintiff's land. There was some dispute as to whether there was such a stream; but it was established that, even if there was, its course was unascertained by the plaintiff before the action was brought. The case was subsequently taken to the Court of Appeal, who decided against the plaintiff. Lord Justice Fitzgibbon, in his judgment, said that, even assuming the stream flowed underground in a contracted and bounded channel and stream, its course was unknown, invisible, and undefined by human knowledge, and that this was the only sense in which an underground stream could be described as "defined" so as to bring it within the exception of *Chasemore v. Richards*. In the case of *Black v. Ballymena Commissioners*, decided in 1886, it was held that, in the expression a "known" underground channel, the knowledge required cannot be reasonably held to be that derived from discovery in part by excavation exposing the channel, but it must be knowledge by reasonable inference from existing and observed facts in the natural, or rather the pre-existing, condition of the surface of the ground. These decisions give, if one may say so, the only intelligible meaning possible to the word "known." They lay it down, in short, that a known channel means a channel of which the existence was known, or at the least capable of being known, by ordinary men before the injury complained of, and not one that might have been then discovered by skilled search. The question whether it was logically defensible to require that an underground stream should be known in order to give the owner through whose land it runs a right to its continued flow, is not touched by these Irish cases. It has already been suggested that since the right to its continued flow is part of the bundle of rights making up the ownership of the land, knowledge of the existence of the stream is as immaterial as would be the knowledge of the existence of a seam of coal to the right to mine for it.

Again, no light has yet been thrown on what the House of Lords in *Chasemore v. Richards* meant by "definite." Is water running in a fissure in the chalk properly said to be in a definite channel? It is difficult to see why not; and yet, if it be so, almost the whole of the underground water in a chalk district would be within a definite channel, though the channel might not be known. Other difficulties as to the application of the "known and definite test" may easily be suggested; and the lecturer confesses, if it is consistent with the respect due to the final Court of Appeal, to a doubt whether the decision in *Chasemore v. Richards* was in this, and perhaps in other parts, altogether admirable.

Turning to other points which remain to be considered, Lord Cecil said it has been thought by some that, though it is lawful enough to abstract underground water for your own benefit, even if it be to your neighbour's injury, yet, if the water be abstracted with the purpose of injuring another—maliciously, as it is sometimes put—this is actionable. The point was directly raised before the House of Lords in 1895 in the case of *Bradford Corporation v. Pickles*. The defendant was an owner of land near Bradford, on which he sank a shaft and level for the purpose, as alleged, of cutting off the Bradford water supply—at any rate, it had, or threatened to have, that effect. The Corporation brought an action; but in the House of Lords, it was decided (affirming the Court of Appeal) that Pickles had acted within his legal rights. The lecturer made a lengthy quotation from the speech of Lord Macnaghten on the allegation of malice and its legal effect if true; and he followed this with a notice of one or two side-issues to the main controversy of the right to underground water. It has been settled, he said, that, if a man allows his sewage to percolate into his neighbour's well, he is liable (*Womersby v. Church*, decided in 1867). This presumably is not because the owner of the well has any right to the purity of the water therein, but because, if a man brings a noxious thing like sewage on his land, he must keep it from doing mischief to his neighbours at his peril. The action lies not because any right of property in the water coming to the well is injured (for, as already seen, no such right exists), but because the health and well-being of the owner of the well is affected by the escape of a dangerous substance from the custody of its possessor. Again in 1869, the case of *Popplewell v. Hodkinson* decided an interesting point indirectly raising the right to the advantage of underground water. The defendant drained his land, with the result that underground water beneath the plaintiff's adjoining land was abstracted. The surface of the plaintiff's land thereupon subsided; and buildings standing on the land cracked. The plaintiff brought his action; but it was held that he could not recover since he had no property in, or right to, the support of the water under his land.

In the next section of the lecture, Lord Cecil discussed the question as to how far the law relating to underground water supply applied to other liquids. In America, it seems to be thought that petroleum is in this respect exactly like water. In England, the point has not yet arisen; but during last summer a somewhat similar question was raised before the Privy Council in the case of the *Trinidad Asphalt Company v. Ambaurd*. Unfortunately, the Judicial Committee of the Privy Council followed the opinion of the Chief Justice in the Court below, who began his judgment by saying: "Asphaltum or pitch is a mineral, not water." Though the law as to water percolating underground seems to have had no application to the actual case before the Privy Council, the lecturer humbly submitted that the distinction on which they relied does not appear to him a sound one. The foundation of the distinction between underground water and solid subterranean products is that nobody can be said to have any property in underground water unless indeed he has actually appropriated a definite part of it. Surely that must be equally true of any liquid beneath the earth, such as petroleum. For, if not, then does it only belong to the owner of the soil where it was made deep down in the recesses of the earth. Such an owner is practically undiscoverable; and all others through whose land it flows have, on this theory, no ownership of it whatever. They have no right or property to it, except when it is actually in their possession. In other words, the relations of a landowner through whose land petroleum flows would, in fact, be precisely the same as those of an owner to a subterranean spring of water. If it be said that subterranean petroleum belongs to a landowner so long as it is in his land, and ceases to belong to him when it leaves it, then his rights, whatever they may be, cease the moment it leaves his land; and from that time he has no more claim to it, or any of the advantages that belong to it, than he would have to an underground stream of water. In either case, the result is reached that there can be no rights of ownership over any natural fluid product of the earth outside the limits of the land in which it is found until it has been appropriated by some person or other. For these reasons, the lecturer respectfully doubted whether the fact that pitch or petroleum is a mineral matter is a governing distinction between it and water. He cannot help thinking that the small value of water compared with mineral oils and the like has been a far more important factor in the development of the special rules of law as to underground water.

It must be remembered that underground water supplies are no longer treated as they were fifty years ago. Then, difficulties of water supply were only beginning to be felt; and it was not unnaturally thought that, where a question arose between the draining of a well and the shutting down of a mine, public policy required that the well owner should suffer. So, too, in a competition between the stream of a mill owner and the water supply of a populous district, it would seem to the plain man ridiculous that the pecuniary interests of the mill owner should be preferred to the physical necessities of his fellow creatures. And the views of the plain man have great weight even on the judicial bench! Now things are rather different. Every corporation and district council has to consider where to get water for its constituents. Remote Welsh mountains and Scotch lakes are made into water reservoirs for towns and cities. Wells are sunk and headings are driven in all the water-bearing strata available; and from them millions of gallons are pumped daily for use by water consumers living many miles from the district under which these strata lie. What wonder, then, that the inhabitants of these districts are loud in their complaints? Never a session of Parliament passes without bitter and costly battles being fought between county councils and other local authorities of such regions as the chalk country to the north and south of London and those who purvey water to the "teeming millions" of the neighbouring cities. On the one side, it is said that the chalk streams are being dried up, and the industries and amenities dependent thereon are being ruined. On the other, it is urged that there is plenty of water for both; and, if not, the few in the country must be sacrificed for the many in the towns. On these occasions much is said about the state of the law; and those who are put in charge of the interests of the country districts

sometimes think the doctrine of *Chasemore v. Richards* presses rather hardly on inhabitants of the country. It may be, they think, right enough to say that no one shall have any property in underground water. They may even feel that the very exception in *Chasemore v. Richards* as to water in a known and definite channel is, in the present state of scientific knowledge, somewhat difficult to defend and almost impossible to apply in other than very exceptional cases. But they are strongly of opinion that the flow of the streams above-ground should be left undisturbed. The doctrine in the *Grand Junction Canal Company v. Shugar* should, in their view, have carried further; and it should have been held that, however legitimate it may be to pump water from beneath your own land, you must so exercise your right as not to interfere with the flow of streams which have always existed, and upon the continued existence of which many hundreds—perhaps, many thousands—have been accustomed to rely.

Such views must, Lord Cecil thinks, command our sympathy. Unfortunately, they are wholly unsupported by authority. The law is clear. It is generally true that all that lies beneath the land belongs to the owner of the surface. To this rule, water is an exception. There is no property in underground water. But, on the other hand, each landowner may pump from his land what water he can get, with two exceptions: He must not directly or indirectly take water already contained in a surface stream; nor must he abstract water flowing underground in a known and definite channel. He has a perfect right to drain the supplies to all his neighbours' wells, however long they may have been enjoyed by their owners. So, too, he may pump till springs miles away have ceased to flow, and threaten to become swallowholes for the streams they used to feed. Further than this he may not go. Once water is in the channel of a stream above or under ground, it is safe from subterranean depredators. This is, Lord Cecil believes, the law. Whether it should be changed, and, if so, how, is another story.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Examination of Water—The Council's Water Bills for Next Session.

At the Meeting of the London County Council last Tuesday, the Chemist (Dr. Frank Clowes) was authorized, on the recommendation of the Water Committee, to continue his analyses of the water of the Thames and Lea above the Companies' intakes, and of the water drawn from the Companies' mains, for a further period of three months, at an expenditure of £37 a week. In the course of their report on this matter, the Committee stated that, owing to the obstacles which had constantly prevented the Council from arriving at any settlement of the question of what was to be the proper system of water supply and water inspection in the Metropolis, they had felt some difficulty in making any suggestions in the direction of improving the existing system of examination. They thought, however, that in any case it might be well if the Local Government Board could be induced to extend their investigations so that at any rate the analyses might be more comparable with those made on behalf of the Council. It seemed to them that analyses of samples drawn from the Companies' mains once a month, or even once a week, could not assure a sufficient estimate of the quality of the supply, and that the only way to ensure a high state of purity in the water supplied to London was by securing a daily examination of the water as delivered to the consumer. The recommendation was not adopted without protest; for Mr. Bond, M.P., who represents Hampstead on the Council, said the grants made by the Council for the purpose in question had been incurred until they amounted to a formidable sum. The reports of the Chemist might be valuable in the sense of being competent and useful analyses; but he (Mr. Bond) questioned their value to the Council. What possible reason was there to saddle the ratepayers with the debt only for the purpose of getting up a scientific squabble between experts? Mr. R. A. Robinson contended that the Council knew practically all that was to be known about the quality of Thames water; and he moved, as an amendment, that the recommendation should be referred back to the Committee, with instructions to circulate the reports of the Chemist among the members of the Council. Dr. Longstaff seconded the amendment. It was, however, rejected by a large majority. The Committee also recommended that a letter should be addressed to the Local Government Board, asking whether they would extend their investigations to a daily examination of the water supplied by all the Companies. This was agreed to.

At a subsequent stage of the proceedings, the Committee submitted their report in respect of the proposed water legislation for next session. They reviewed the action of the Council during the past nine years in their attempts to obtain control of the water supply, and referred to the obstacles they had met with. The Royal Commission appointed in 1897 to deal with the water question had not yet made their report, though they had been considering it for seven months; but there was reason to believe that it would be issued before the end of the year. In these circumstances, the Council were in exactly the same position of difficulty that they were a year ago. The Committee then dealt with the events of the past summer, and stated that they had been such as to again force to the front the question of water supply. If, they said, the drought of 1898 was such as to render it advisable for the Council to attempt to obtain legislation in 1899, that through which we had lately passed, which had been far more severe, appeared to make it absolutely essential that the Council should not lose another year in pressing forward their proposals. After citing figures in regard to the flow of water in the Thames, which, however, did not give a true idea of the real extent to which the river was being depleted by the Water Companies, the Committee said they were once more forced to the conclusion that the ultimate supply of the Metropolis could only be assured by resorting to a source other than the valleys of the Thames and the Lea; and, moreover, that it was urgently necessary that a scheme for this supply should be set on foot without a single year's delay. They accordingly proposed that the Council's Welsh scheme should again be presented to Parliament; and if the Government again refused to allow it to go before a Select Committee, the responsibility would at any rate not be upon the Council. The scheme was practically the same as that of last year. Further consideration of the question, and negotiations which had been carried on with landowners and others, had, however, led the Engineer (Sir A. R. Binnie) to make certain amendments in detail, of which the principal consisted in moving the site of the dam of the great reservoir somewhat higher up the valley, whereby a greater capacity and a higher water-level would be obtained. Alterations had likewise been made in the line of conduit down the Valley of the Upper Wye and in the position of the bridge which was to carry the main conduit over the Severn at Gloucester. They also proposed that the whole of the Welsh scheme should, on this occasion, be embodied in one Bill. Last year, owing to want of time, the Council had to deposit separate Bills for the construction of the reservoirs and for making the conduit. But, under the authority given them in June to commence the necessary preparations, the officers had been able to make considerable progress with the plans and the referencing; and there would now be no difficulty in giving the requisite notices, &c., for the promotion of one complete Bill. With regard to the Purchase Bill, which the Committee recommended should be introduced in the session of 1900, they made only a few observations. They pointed out that the Council had repeatedly expressed the opinion that the undertakings of the London Water Companies ought to be purchased, provided they could be obtained on fair and reasonable terms; and up to the present nothing had occurred which, in their opinion, would lead the Council to take any other course than to renew their former application to Parliament. It was possible that, when the Royal Commission had reported, they might have to reconsider their position; but at the present moment they could only recommend that a Bill should be deposited for compulsory purchase, in the same form as that of last year, subject, possibly, to certain alterations in details. They had requested the Finance Committee to report upon the financial bearings of the proposals set forth. The Committee concluded by recommending—(1) That a Bill be promoted in the session of 1900 for the purchase by the Council of the undertakings of the eight Metropolitan Water Companies, upon similar lines to those of the Bill presented to Parliament in the first session of 1899. (2) That a Bill be promoted to enable the Council to obtain and introduce into London an additional supply of water from the watersheds of the Wye and the Towy. (3) That it be referred to the Parliamentary Committee to prepare and present to the Council the Bills for carrying out the above recommendations, including the preparation of the necessary Water (Finance) Bill. Under the Standing Orders of the Council, the consideration of the report was adjourned for a week.

THE PROPOSED PURCHASE OF THE FALMOUTH WATER-WORKS BY THE CORPORATION.

Another Adverse Vote of the Ratepayers.

The question of the purchase of the Falmouth Water Company's undertaking again came before the ratepayers of the town last Tuesday, when the statutory meeting of owners and occupiers was held to consider the proposal of the Corporation to promote a Bill in the ensuing session of Parliament.

The Mayor, in moving a resolution in favour of the purchase, spoke of the injury done to the reputation of the town by reports of outbreaks of infectious diseases, and said the seventy cases of typhoid and twelve deaths which had occurred in the high-level district were not due to chance. Mr. Silverthorne had told them that the high-level reservoir had been fouled. Dissentient members of the Council had made a fierce attack, not on the purchase scheme, but on the author of it. Mr. Silverthorne was the ratepayers' expert; and his espousal of the ratepayers' interests brought him into conflict with all the supporters of monopoly.

Mr. H. S. Mackenzie seconded the motion.

Mr. J. G. Cox, Manager of the water-works, remarked that he was not against the purchase of the water undertaking, if it could be shown to be for the benefit of the ratepayers. The Mayor had in a shameful manner tried to attribute to the water the outbreak of typhoid fever which had occurred; but the water was equal in quality to that supplied to half the towns in the kingdom, and better than a good deal of it. The system of filtration was exactly the same as that adopted in London for the purification of the water of the Thames. He invited the meeting to consider whether such a scheme had been worked out as would result in benefit and not loss to the ratepayers. Was it likely that the Water Company would sell their undertaking, after repeated attempts to depreciate its value, at less than the highest terms they could enforce? If not, the ratepayers must be prepared to pay about 25 per cent. above the valuer's figures for compulsory purchase. Was it to be supposed that the attempt to obtain an Act would succeed in face of the probable opposition? If it failed, the ratepayers would have to bear all the costs. Was a case known where an Act was obtained in face of divided opinions in the Corporation, or of the fact that of the £3500 worth of shares reserved for the inhabitants at the commencement of the undertaking none were taken up? The ratepayers had not been shown how the deficit which would accrue through the change of basis on which the water-rates were charged would be met, nor how the loss of rates now paid by the Water Company was going to be dealt with. In the past 25 years, the Company had spent £23,000 in extensions and improvements; and at present works which were being carried on at Penryn involved an expenditure of many hundreds of pounds. The public were asked to believe that the Directors of the Water Company existed only to reap dividends. A greater falsehood was never put into print. If a Committee were appointed to go carefully into the matter, and ascertain whether a scheme of purchase was practicable or desirable, he would do all in his power to assist them. The Directors of the Company would gladly place before the shareholders any fair and businesslike offer which might be made.

Mr. W. W. Phillips warmly denounced the purchase scheme, and declared that if it were adopted, and the control of the water-works placed in the hands of the present Corporation, Falmouth would be bankrupt in five years.

Mr. J. Mead said it was unfair to ask the ratepayers of Falmouth to consider the question of the purchase of the water-works before the Corporation had endeavoured to enter into an arrangement with Penryn. Unless they did make such an arrangement, they would be in danger of embarking upon a costly lawsuit, and perhaps of losing one-fifth of the

customers of the water-works. It was unfair to condemn the water for the purpose of advancing the purchase scheme. The water had never been proved to be bad; and the proper course was to wait for the report of the Local Government Board Inspector upon his recent inquiry as to the cause of the outbreak of fever.

Mr. J. C. Downing also protested against the inference drawn by Mr. Silverthorne, that the water was the cause of the epidemic. Had there been any honest endeavour to carry out the suggestion of an amicable arrangement with the Water Company?

The Mayor: There is nothing to prevent that now.

Mr. Downing said in that case there was no need for the meeting. The *crux* of the case was an arrangement with Penryn, towards which there was no approach.

Mr. F. J. Bowles said no one was more convinced than himself of the desirability of the Corporation purchasing the water-works; but the resolution before them would not bring it about.

Dr. Banks agreed that the town ought to own and control the water supply; but he objected to the manner in which the municipalization scheme was rushed. He did not agree that the typhoid fever cases were attributable to the water; his experience being that those he had attended could be traced to defective drains.

Others speakers addressed the meeting, which heard with much impatience the advocates of municipalization. On the resolution being put, only eight or nine voted for, and an overwhelming majority against it. A poll was demanded.

SEARCHING FOR WATER WITH THE DIVINING-ROD.

In the current number of "Nature," Mr. C. V. Boys, one of the Metropolitan Gas Referees, reviews at some length the book published by Mr. B. Tompkins on "The Theory of Water Finding by the Divining-Rod" which was noticed in the "Journal" for the 18th of July. His concluding observations are as follows: There seem really to be two questions: (1) Can the water-finder by his sensations, whether with or without a divining-rod, indicate the position and yield of a hidden spring without employing any knowledge of geological conditions or experience as to the lie and appearance of the land? (2) If so, has the divining-rod anything to do with his success? Of course, if he succeeds in consequence of mere reasoning based upon geological knowledge or experience, while none the less useful to the public, he is, as far as divining is concerned, a fraud. Reasoning beings would require very strong evidence to be absolutely satisfied that the first question can be answered in the affirmative. Yet a gentleman known to me personally, with mechanical and scientific ability and plenty of common sense, is persuaded, from what he has seen, that a water-finder can locate hidden water, and that he does so by feeling a sensation. The water-finder asserts freely that the divining-rod has nothing to do with the business at all. This gentleman's son, formerly a student at the Royal School of Mines, now a professional engineer, in whose ability and honesty I have absolute faith, went round with the water-finder, and noticed that he, too, was cognizant of some sensation when the water-finder found indications of water. Mr. Tompkins quotes, and I suppose correctly quotes, a letter from the Chairman of the Quarter Sessions for Herefordshire to the "County Council Times," in which he states that, out of curiosity, he went round with a water-diviner, and found that he could use the rod successfully himself. While he has no occasion to do this professionally, he now uses it to discover leaks in the embankment of a large piece of water on his estate, caused by rats or rabbits, which he could not easily find otherwise. Scores of examples might be given. As I have stated, it does not seem a logical position to take up to say that the gift as distinct from the art is impossible, even though we may require a better quality rather than quantity of evidence than is available to be satisfied as to its reality. But the gift, if it exists, is not sufficiently dramatic to impress the public. It is here, to my mind, that the rod comes in. The forked twig, held as it is, can be made to rise, fall, or rotate by an almost imperceptible movement of the hands, possibly after a time unintentionally on the part of the water-diviner, and the public are impressed. For the same reason it may be well to find that water can only be met with in some inconvenient position, such as under a haystack or the cellar of the house, or the corner arch of a large granary. Ignorant and credulous people will have much more faith in you if you put them to a little inconvenience. If the water-finders would leave it here, there could be no cause of complaint, provided, of course, that they succeed where geologically trained people fail. But when they put forward preposterous "scientific explanations," it makes it very difficult not to come to the almost inevitable conclusion that the water-finder has no case, and that the surcharging of his fees by auditors is necessary for the protection of public bodies. Perhaps among the 130 references in the Bible to the rod, staff, or sceptre, is this: "A whip for the horse, a bridle for the ass, and a rod for the fool's back."

Retford Corporation Gas Undertaking.—The annual report of the Retford Corporation gas undertaking shows that the expenditure on capital account in the twelve months has been £1296. The gross profit for the year is £2098, as against £3109 for the preceding year. The decrease has been caused by the heavy expenditure for renewals of plant and a reduction of 2d. per 1000 cubic feet in the price of gas, as well as the increased cost of coal.

The Cost of Public Lighting at Bury.—From a recent report on municipal expenditure at Bury, we find the comparative cost of street lighting with (*a*) electric arc lamps, (*b*) incandescent gas-lamps, and (*c*) 2-light gas lamps is as follows: (*a*) 29 electric arc lamps, placed 60 yards apart, 1000-candle power each, cost £17 10s. per lamp; estimated illuminating power, 29,000 candles; cost per annum, £507 10s. (*b*) 59 single incandescent gas-lamps, 60-candle power each, burning 3½ cubic feet of gas per hour, cost £3 1s. 6d. each (including mantles, chimneys, and men's time), placed 30 yards apart; estimated illuminating power, 3540 candles; cost per annum, £181 8s. 6d. (*c*) 59 2-light gas-lamps placed 30 yards apart, 40-candle power, and burning 10 cubic feet of gas per hour, cost £3 8s. 1d. each; estimated illuminating power, 2360 candles; cost per annum, £200 16s. 11d. The distance lighted in each case is a mile.

THE VALUATION OF WATER-WORKS.

At the Meeting of the American Society of Civil Engineers last year, a paper on the above subject was read by Mr. Wynkoop Kiersted. It gave rise to much discussion at the time; and it has now been printed in the "Transactions" of the Society, with the remarks of the various speakers. One of those who expressed his views on the question was Mr. Rudolph Hering. His remarks were given in a recent number of the "Engineering Record," from which we have made the following extracts:—

The valuation of water-works property should be considered, both from the engineering and business points of view, just as the value of a plant furnishing light, heat, or transportation, or just as the value of a mill or other establishment producing a commodity, would be determined. The party having a desire to buy or sell is naturally willing to pay more or get less from the other party than if there was no such desire; but in an engineering discussion the subject should be treated irrespective of the law of supply and demand, and be limited to the proposition that a property is to be transferred and paid for at a price which is to be equitable to both parties.

There are three cases to be considered—one where there is no franchise, another where there is a limited franchise, and still another where there is a perpetual franchise. The speaker could not see how a water-works franchise could continue to have any value whatever after it has expired and the contract has been terminated. In such a case it is not fair to the citizens to assume that one still exists, and to determine the purchase price accordingly. When a franchise is limited and still in force, or when it is perpetual, it undoubtedly has a specific value. Sometimes the contract provides that the city shall purchase the works after the expiration of the franchise, and prescribes the method of arriving at the price. In such cases the question of value is therefore settled. Engineers are interested only where it is still open to arbitration, and is to be answered on an impartial basis, founded upon engineering and mathematical as well as on business facts. When a contract is to be renewed for another term of years, both the city and the company should be willing to revise the terms, in view of the experience gained with it, and upon which judgment should thereafter be based.

There are several customary ways of ascertaining the value of water-works—viz.: (1) Capitalizing revenue. (2) Ascertaining the cost of the original construction and establishment of works, less depreciation of existing structures and materials. (3) Estimating the cost of reproducing similar works, less depreciation of existing structures and materials. (4) Estimating cost of reproducing such parts of existing works as can be embodied in a new and modern system of water supply for the city. In comparing them and deciding upon a preference, a broad and fair view should, of course, be taken.

The author's conclusions point to a preference for estimating the value of water-works property by capitalizing its net earnings. The speaker could not agree with such a conclusion for the following reasons: A slight difference in the net earnings represents a great difference in money value when capitalized. The net earnings must therefore be determined with much accuracy. They depend partly on water-rates, partly on the ability of the management, and partly on other conditions. If the water-rates are unalterably fixed for the life of the franchise or contract, the question is settled; but if the city has the privilege of changing them, it has the power of greatly affecting the capitalized value. They are therefore not wholly based on intrinsic value, but partly on the opinions and actions of the temporary city officials. If the management of the water-works property is an able one, the net earnings will be materially better than if it is not. It is proper to keep the expense account down as much as possible; but this may be accomplished not merely by reducing the cost of administration and operation. It is something done by a failure to keep works in proper repair, or by furnishing inadequate fire pressure or an insufficient supply of water for domestic use. With ulterior purposes in view, the net earnings may have been artificially swollen or reduced for a year or two. During the term of a franchise, city officers seldom have any control, whether over the design, construction, or management of the works which are later to be placed under their entire control; and thus, after the franchise is awarded, no one may have power to guard the city's interests. In such cases, the capitalized value may depend partly on the accidental ability of certain of the company's officers, and partly on their methods of administration, rather than on intrinsic merit alone.

There is another difficulty. It is often presupposed that the conditions producing the earnings are constant, and that some of them are perpetual. The most important of these are the permanence of the quality and quantity of the water; but both may change. The quality may by pollution, over which the company have no control, become so bad as to make the water unfit for use. New works up to the point of distribution must be built; and the net earnings are correspondingly reduced. The quantity of available water may also be diminished by a change of surface conditions; or, as in some ground-water supplies, a portion of the water may have been diverted, against which there may be no legal remedy. Then, likewise, the net earnings are reduced by expenditures necessary to make good the deficiency.

Another difficulty lies in the selection of the rate of interest which is to be used for capitalization. A slight difference in it makes a great difference in the reduced value. There are temporary and local conditions which can easily alter the rate ½ or 1 per cent.; making the difference in the capitalized value so great that a close analysis in other directions becomes of little value. Therefore it is again necessary to depend largely upon human actions; and in this case, perhaps, upon the pleasure of the parties, and perhaps upon a biassed judgment in fixing the rate of capitalization.

In selecting this rate, an important consideration is often ignored. It should vary with the expected age of the works. If they are not to be operated long, the rate must be higher than if they are practically perpetual. In new and in "mushroom" cities, the rate must therefore be higher than in the old and established ones. Unless the proper lengths of time for which to capitalize can be determined (which length of time is often but a vague surmise), how can the rate be given with sufficient accuracy to use it for capitalization on an equitable basis? In such a

case, it is almost impossible to fix a rate that would be considered fair a few years hence. Further, the interest rate, as a general matter, varies also with the times. It is lower now, for the same purpose and in the same cities than it was twenty years ago. The method has still another objectionable feature. When a franchise is awarded, and when a city parts for a term of years with its own rights and properties, it happens occasionally that it is asked to buy these properties back at a concealed price, which, on close examination, proves to be far above market rates. This price has been made exorbitant by deriving it from the total earnings of the company, which may have been made large from other and, some of them, perhaps temporary causes. Therefore, when recalling, as it were, a temporary loan to the company, the citizens are to receive less than they gave.

The capitalization of earning, as a practical basis for determining the value of a property, is therefore beset with many uncertainties, and is likely to produce much injustice. The result depends partly upon possibly irresponsible persons, and partly upon those whose only object may be money-making. In any case, it depends largely upon individual judgment, based upon elements of which some are incapable of accurate determination. To get with it a valuation that has a semblance of justice and accuracy seems almost hopeless. It removes so important a business transaction as the purchase or sale of water-works far from the basis of ascertainable facts; and the valuation is left largely to the mere opinions of those selected to arbitrate. Therefore the result must be hazardous, and explains the great discrepancies often existing between the figures defended by the two parties.

Nevertheless, it must be admitted that logically the method may still be a just one in many cases; and where none other is practicable, it must stand with its consequences. The Courts have often favoured it; but their decision was then based on the evidence submitted and upon the terms of a contract. In a case depending largely upon engineering knowledge and judgment, a Court will rarely go outside the evidence.

It must also be admitted that, if all proper deductions have been made, and a reasonable view has been taken regarding the interest rate and the time for which the works are capitalized, then there will and should be but little difference, if any, between the value ascertained in this manner and the value ascertained by other methods which embody elements of less uncertainty.

When the franchise has not expired, and the city has obligated itself to buy the works, and has bound itself to recognize the schedule of water-rates as representing a proper income for the company, then there may result an excessive valuation—a sort of speculative value, which the city is, nevertheless, bound to accept under the terms of the contract. Besides the values which have been determined without considering a specific franchise value, we should add all profits which are expected to be realized between the time of purchase and the time when the franchise expires. When the franchise has expired, and the company has properly anticipated a decline in prices for material and construction, if it has allowed for the uncertainties of the growth of the city, if it has naturally or artificially secured pure and wholesome water of unfailing quality, if it has used the best materials and appliances, and conducted the work in a skilful manner, and if the water-rates are reasonable and commensurate with the cost of the works and their operation, then the income will provide but a fair profit or percentage on the invested capital. Then, also, the reverse operation of capitalization will reproduce about the same result as when a direct determination of the capital is made by estimating the cost of establishing works and of their operation. If a company lose money by such a method, they have generally lost it because the intention was to speculate, or the officers were inefficient. Then the company alone should be responsible for the error of judgment, just as other investors owning other kinds of property; and they should not wish to load the responsibility upon the unsuspecting taxpayer of a community.

The author asks at the end of his paper how it will be known whether the water-rates are equitable or not; but he answers it in a hardly definite or satisfactory way. It seemed to the speaker that the rates can be equitable only if they pay the cost of establishing the works and maintaining and operating them, and yield but a fair and not exorbitant profit on the invested moneys. The difficulty in fixing equitable rates at the outset lies in the uncertainty as to the number and kind of services that will be supplied each year. It would be easier and safer to determine an equitable rate on the basis of 1000 gallons supplied to the city, both for public and private purposes, because there would be more definiteness in the elements of the calculation.

Much confusion of judgment is often caused with reference to these water-rates. In some cities they have been called excessive, and in others not, while exactly the reverse was true. The rates should be based on the outlay for the works and their maintenance, and on the cost of their operation. If the works are expensive and the cost of operation, perhaps by pumping and filtering, is great, the rates may easily and justly be double what they are in another case, where, for instance, the delivery of pure water is readily obtained by gravity.

A change of water-rates by a city council affects the revenue of the company. Therefore, the city can, on the capitalization plan, easily control the supposed value of a plant to the company, unless such a change is prevented by contract. A reduction of the rates can cheapen, and an increase can raise, the value. Injustice may consequently be easily done to either party. A capitalization of the income from schedule rates, therefore, presents numerous difficulties in the way of reaching a fair valuation, and allows judgment to become unnecessarily obscured. This method should, therefore, not be favoured whenever a better one may be substituted.

In this method of capitalization, the author makes no discrimination between perishable and more permanent works. In the speaker's opinion, the repayment of bonds should be based upon the life of the work for the payment of which they have been issued. Bonds representing machinery and the distribution system should be given a shorter term than those representing land, right of way, water rights, and large reservoirs; and, irrespective of the time-limit, bonds, for instance, on real estate can be placed at a lower rate of interest than bonds on machinery and piping.

A city can borrow money at a lower rate of interest than a company. Therefore, when capitalization is based on the interest paid by the cities, the valuation will be higher than when it is based on the higher rate usually paid by companies. In some cases the difference has been overlooked, to the detriment of the citizen. When a city has exhausted its borrowing powers, it is benefited by a company furnishing the means to carry out public works, and is willing to pay a higher rate of interest for the assistance; but after paying the higher rate, it should not be called upon to pay the greater capital due to its own better credit, but the lesser capital due to the credit of the company to which, through the water-rates, it paid a greater interest.

Although the capitalization principle, when applied to water-works, may be just when the rates are fair and reasonable, yet, in order to determine whether they are so, the cost of the water-works and of their operation must be known. This cost, then, should be determined in any event; and, if so, it is right to take it at once as the basis of valuation.

A valuation based on the original cost, including the establishment of the works and the ordinary repairs, but deducting for depreciation, is not approved by the author, nor should it be. The uncertainties may be about as great as in the former case, if it is considered that the works are sometimes at once bonded for the capitalized value of the expected income, rather than the actual cost. Nor is it always possible to ascertain this actual cost; and it must then be estimated on data applicable at the time of construction. The actual cost of a property years ago is not a true measure of its present worth to its holder. Certain moneys may have been spent injudiciously, leaving him no value whatever. He may not even have had control of the original expenditure; and why should a purchaser pay for the errors made by others? The true measure can only be the present market value, if this term is properly interpreted. Contrary to the author, the speaker thought there ought to be no difference whether errors originally made were wilful or not. If they are errors at all, they should be corrected in the valuation.

A valuation based on the present cost of duplicating the works is, in the speaker's opinion, a safer and more equitable method than the former one. He cannot agree to the assertion of the author regarding this case—that no company would invest money for building up a business and accept but a scrap value for the plant and business. A company are supposed to know what they may eventually be obliged to accept, according to the terms of their own contract. They therefore have arranged their original bid and their business conduct so as to come out whole and with profit to the termination of the contract. In comparison with the former method, it gives a lower valuation, because the cost of the materials and labour have generally declined during the last twenty years, and because unknown conditions then existing are ignored. It increases the valuation because there are more streets opened and paved, more railroads and other improvements which add to the expense of construction, and because there has been a general rise in value of real estate.

The uncertain factor in this method is the deterioration of the piping. Its life depends upon the original quality of the material and workmanship, on the character of the coating, the soil in which the pipes are laid, and the water which flows through them. Pipes have in recent years also been subject to corrosion by electrolysis near electric railways, unless protected. They will last, as a rule, from 20 to 60 years. In order to estimate more closely their probable life, inquiry should be extended in these directions as far as practicable, and as many actual examinations made as may be deemed necessary. The deterioration of hydrants, valves, and machinery is more easily determined. It should be remembered that this factor of deterioration applies equally in every other method of valuation; and, therefore, also when capitalizing the net revenue. The sinking fund should be adjusted so as to provide for replacement of, or payment for, all perishable material in due time.

The author thinks the rejection of small pipes from the assets of the company is not just. This may or may not be so. If these pipes are no longer of use by failing to give adequate pressure or quantity of water even when reinforced at all available points, then they must be taken out and replaced by others. They have then only a scrap value. Where a small pipe continues to be useful, or can be made so by reinforcement, it certainly has a value by taking the place of a pipe that would have to be laid in its place. The original value has been decreased only by deterioration, which has made its life correspondingly shorter. If, for financial reasons, a small pipe was originally used, it must be assumed that suitable compensation has thereby been obtained. When the franchise has expired, the pipe has served its purpose; and if it has no further intrinsic value, no payment ought to be justly asked for it.

To arrive at a fair valuation, a discrimination should be made as to whether or not the rates have been sufficient, in addition to paying for economical running expenses, to provide also for a sinking fund which would return the invested capital. If the water-rates were so high that the capital has been returned, then the citizens are entitled to this benefit, and should receive the works at a mere nominal sum. If the rates were not high enough to permit the entire capital to be returned, and some of it is still secured by the existing real property, then the citizens can be equitably asked to pay the sum which is sufficient to remove the indebtedness. An increase over such figures represents a bonus to the company, to which they may or may not be entitled.

It has been said that the cost of securing and establishing a profitable business of supplying citizens with water, and of securing their patronage, should be paid for by the citizens. This is undoubtedly true and fair; but the cost has been, or should have been, covered by the schedule of water-rates. A further allowance at the end of the term would then be its duplication. It has also been said that the losses of interest during the construction, and insufficient revenue during the first few years, should be especially paid for; also the risk owing to the uncertainty as to the city's growth and expansion, and a depreciation in the price of material and labour since the works were constructed. But, again, a company should have aimed to adjust their schedule so that they could pay for these contingencies, and a further allowance would be a duplication.

Whatever risk there is in building up a water-works plant should be allowed for in the schedule of rates, unless the contract provides for the contrary, and specifies a payment for it directly or indirectly when the franchise terminates. Unless there is this provision, it is not to be supposed that such a payment is relied upon. Nevertheless, there is an element of fairness in a company claiming a somewhat greater capital than can be obtained only by the above-mentioned proceedings. There is a difference in the relationship of a water-works company to a city and in that of two parties each of which is wholly independent of the other. If a city wishes to own its water-works it can usually choose to buy the company's works or to build new ones; but a company may then have an unfair alternative. They must either sell their more or less

efficient plant to the city, or sell it to a scrap dealer. It may deserve the latter fate, or it may not. If it does not, and the rates have been fair and the service good, the citizens should be willing to give a bonus, and pay for at least as much of the plant as can still be used by the city.

There is one feature that gives this method of valuation a dangerous aspect, in case it has been agreed upon in the contract as a mode of paying for the property. It is meritorious only when the works have been economically designed and built; but, with a view to such a settlement, the Company may have undertaken extravagant expenditures for works in directions where they could secure a special profit for themselves; and these, by contract, the city would be obliged to pay for, without, perhaps, needing the additional works at all. Barring this contingency, the method appeared to the speaker to be a fair and equitable one.

When a franchise has expired, and there exist, by reason of a contract or under general laws, no further obligations between city and company, then it would appear that the fourth and last method mentioned at the outset of ascertaining the value of existing water-works is the only proper one. It is based on the supposition that the city has plans made for a new and modern system of water supply, up to date in every particular, and with a suitable provision for future requirements. Then, if the existing works, or any part thereof, or any property of the company, can be utilized or embodied in the new system, such works or property should be taken and paid for at fair market prices, in view of the fact that, in case of rejection, there would be an actual destruction and loss of something which without question has some real value. From the premises, it is supposed that, by the expiration of the franchise, the money expended for property that is useful only for the purposes of water supply has been returned to the company. Real estate, being useful for other purposes, has, of course, a market value independent of any moral or other obligations pertaining to water-works transfer.

In conclusion, it appears that either estimating the present cost of reproducing similar works, when those existing are to be taken by the city, or the present cost of reproducing only those parts which can be embodied in a new system to be built by the city, furnishes the most fair and equitable means of valuation when the franchise has expired and no further obligations exist between the parties. There is no dependence placed either upon human judgment when verification is impracticable, or upon human actions when they cannot be controlled. There are but few elements of uncertainty, and these are substantially confined to estimating the cost of construction, maintenance, and operation, and of the rate of depreciation of materials and machinery. It is right to assume that such estimates of cost, whether of existing or projected works, made by intelligent and experienced engineers, will be reasonably correct within a few points of percentage, and that they may be verified to any extent that may be desirable. It is right to assume further that the character and depreciation can be ascertained within reasonable limits by a close examination or test of the works as they exist, both under and above ground.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The report by Mr. W. R. Herring to the Edinburgh and Leith Gas Commission on Monday, showed the very gratifying increase in the output of gas during September of over 9½ million cubic feet, as compared with September of last year, and an increase since May 16 of over 30 million cubic feet. The Chairman (Bailie Kinloch Anderson) pointed out that the increase during September was equal to 8·64 per cent.; and since May 16, to 8·11 per cent. The Chairman also intimated that the Commissioners had not many army reserve men in their employment; and that the Works Committee had resolved that the men who had been called up should have their places kept open, and should receive the same scale of pay while they were away as was to be paid by the Edinburgh Corporation to their men. There were no reserve men employed in the Leith works. Mr. Kinnaird, of Leith, whose nose would seem to be particularly well adapted for ferreting out subjects which are not agreeable all round, mentioned that the public did not care a snuff about the increase in the output; what they wanted was cheaper and better gas. The Chairman made a courteous explanation to Mr. Kinnaird. Were it not, he said, for the increased quantity of gas they were yearly making, the price would have been higher than it is—especially this year, when, as they would see from the minutes before them, coal was so much dearer. It was their duty, and their constant desire, to do the best they could, both in the matter of the quality and price of the gas; and he did not think the gas was worse than it ever was, except, perhaps, to the extent of about 1-candle power, which the Commissioners took off several years ago.

The Chairman then dealt with the question of the men's wages. The Works Committee, he said, had resolved to offer the stokers an increase of ½d. per hour; making their wages 8d. They worked eight hours; and thus the daily wage would be 5s. 4d. The men made a request that they should be paid time-and-half on Sundays; but the Committee were of opinion that the stokers knew perfectly well, when they entered the service of the Commission, that there would be Sunday work, and that therefore there should be no consideration for it. The stokers had 24 hours off once every three weeks, in consideration that they worked a double shift of 16 hours once every three weeks. It was thought that they were being employed on very fair terms, and that, while they were, perhaps, only a better class of labourers, they were being paid at the high rate of 8d. per hour. In respect of the purifier men, and the other men generally, they were only occasionally required to do Sunday work; and the Committee recommended that they be paid at the rate of a third more for the hours they worked on Sundays. In the Committee there was a minority who were in favour of time-and-half being given to these men; and he supposed they would again divide upon the subject. He moved the recommendations of the Committee. The proposal with reference to the stokers was agreed to unanimously. Mr. Mallinson then moved that the other men receive time-and-half, because, in offering one-third more for Sunday labour, they were giving less than was allowed for ordinary overtime. The recommendation of the Committee was adopted by 12 votes to 5.

A letter from the Town Clerk of Leith was next submitted, suggesting a conference with the Leith Town Council upon the subject of the desirability of constructing subways for the reception of gas, water, and other pipes. Several of the Edinburgh representatives condemned the proposal, on account of the great cost it would involve. It was then communicated by a Leith representative that the suggestion was only made with reference to new thoroughfares. This explanation put a different complexion upon the proposal, and it was agreed to have a conference. The Leith representatives being all members of the Town Council of Leith, it was agreed that the Edinburgh representatives on the Commission should be sent to the conference.

The Corporation of Dundee have come to terms with their gas workers, thereby averting a strike which was to have been begun at 6 o'clock on the morning of last Monday. On the Saturday a Committee of the Corporation met the men in one of the retort-houses. The men said they considered their demand for 1d. per hour increase was only fair and just, for the reason that their work was hard and trying, and their wages had long been behind those paid to similar workmen in other towns. One of the Committee pointed out to the men that it was the wish of the Corporation to do right to all their employees, but that they had also ever to keep in mind the public interest. The application for an increase had been sprung upon them rather inopportunely, because, as the stokers well knew, the estimates for the current year's expenditure had been made up, and such an advance as was asked could not very well be granted without causing dislocation of, or at any rate inconvenience to, the municipal exchequer. The Gas Committee had agreed to offer an increase of ½d. per hour; and the Committee urged the men to accept this proposal, which would make their wages 5s. per day, and 35s. per week. The men retired to consult; and in a few minutes returned to the Committee, and intimated that they accepted the offer of ½d. on condition that at a later date their claim to an advance of 1d. per hour should be considered. A squad of 41 other workers then put forward a claim for an increase of wages; and the Committee similarly made an offer to them of an increase of ½d. per hour, which the men accepted without any further demur.

There can be no doubt but that the remark of Bailie Doig to the Dundee gas stokers, that an increase of wages would disturb the estimates for the year, brought out a feature of the situation which is apt to be forgotten by the men. Estimates are, of course, nothing more than expectations, and they are often exceeded; but the framer of an estimate likes to work as near to it as possible. The increases which have been granted in Dundee and Edinburgh will eat seriously into the expected surpluses. They were, perhaps, unavoidable, and therefore must be borne; for wages all round are going up. I daresay what has been already given would be endured with greater equanimity were it understood that no more would be asked. But what of the other classes of workers? Will they be content to go on at present wages, if they see that increases are being given?

In the report of the proceedings of the Oil-Gas Enrichment Company, given in another column, it will be observed that it was intimated that Messrs. Young and Glover have sold to the Company their rights in the patent taken out by them in June, 1895, for the enrichment of gas by means of cannel. The Company now possess patent rights for enrichment by both oil and cannel, and will be in a better dividend-earning position than they have yet been. If cannel becomes cheap and oil dear, which has happened in the history of this Company, then cannel will be adopted as an enricher. If, on the other hand, cannel should go up in price and oil become cheap, then oil installations would become profitable. The Company are thus in a position to hold the balance of the market. There is a great advantage in adopting the cannel process in that new plant is not required for it. It can be worked in ordinary retorts and other apparatus; and consequently its adoption is merely the matter of the time required for negotiating terms. As to the economy of enrichment, either by oil or cannel, there can be no question; that has been demonstrated by all who have used the processes. The further benefit of the removal of naphthalene is an important one; and both of the systems possess it. It is a subject upon which, as we all know, Mr. Young, of Peebles, has thought a great deal; and his deliberations have been to some purpose. Mr. Young is a great benefactor to the gas industry; and in this instance he has acted most generously towards the Company who took up his oil patent. The success of the cannel process would have been the loss of the Company, if they had only had the oil system; and the patentees, mindfully taking this view of the matter, made their first offer of the patent to the Company. The Chairman was able to announce that the process was being taken up in large towns in England. It will be some time before their experience of it comes in; but when the results become known extended inquiries after the process will follow, and thus another great assistance will have been given to gas managers through the medium of the intellect of Mr. Young. Readers of the "JOURNAL" will be sorry to learn that Mr. Young, who has been laid aside for some time, was too unwell to attend the meeting of the Company.

An exhibition of gas appliances on a more pretentious scale than usual has just come to an end in Aberdeen. A local Committee was formed to get up an industrial exhibition; and Messrs. Richmond and Co., working in conjunction with the Committee, and with the Corporation Gas Department, placed on exhibition a large show of their newest "Model" cookers and other gas appliances. The exhibition was open for three or four months; and as an outcome of it, I understand, nearly 300 cookers and stoves have been hired out or sold in Aberdeen.

Mr. R. Hamilton, the Inspector of Lighting for the Corporation of Glasgow, has been experimenting in Bath Street, Glasgow, with anti-vibrator fittings for the Welsbach incandescent gas-lamps, and is so satisfied with them that he recommends an extension of the system. The burners cost 9s. each; and he finds that, with the anti-vibrator, the average life of a mantle is 1018 burning hours, and the annual cost of renewal 3s. per lamp.

Some dissatisfaction is being expressed in Arbroath on account of the Gas Corporation having, when in July they raised the price of gas from 3s. 11½d. to 4s. 2d. per 1000 cubic feet, made the increase retrospective to April last. I rather fear it is illegal to do so; but whether it be so or not, it is not commendable to make a rise retrospective. A reduction in price is different. No one would object to pay less than he expected; but when customers are called upon to pay more, it is almost a certainty that there will be grumbling on the part of some of them.

A fatality occurred at the Alloa Gas-Works a few days ago, in connection with the sulphate plant. A young man named Archibald Kellock, whose duty it was to attend to the pipe conveying the sulphuretted hydrogen to the purifier, removed the plug in the bend to allow of the accumulated water therein being run off, and in so doing inhaled the gas, by which he was overpowered. He was found in an unconscious condition almost immediately after the occurrence; and medical aid was summoned. But life was extinct.

In the course of last month a Special Sub-Committee of the Glasgow Corporation Gas Committee, appointed to deal with a claim for extras on the gasholder tank at the Temple Gas-Works, reported that they had taken into consideration the claim made against the Corporation by the Contractors (Messrs. John Paterson and Son), for the alleged extras, amounting to £9985 11s. 3d., and also an application by them for a payment to the account of the balance due under the contract, as certified by the Treasurers on the 9th of March last. The Sub-Committee resolved to recommend that a sum of £1062 1s. 11d. be paid to the Contractors to the account of the balance certified to be due to them, and also that the claim for alleged extras be repudiated, and any questions between the Contractors and the Corporation with respect thereto be decided by the arbiter under the contract. They further agreed to recommend that a counterclaim be made against the Contractors for the penalty and liquidated damages stipulated in the contract, on account of the delay which had taken place in the completion of the work. The last recommendation bears out the statement by the Contractors for the gasholder (the Barrowfield Iron-Works Company) which appeared in the "JOURNAL" for the 17th ult., as to this delay seriously interfering with the completion of their contract.

It may be remembered that several years ago the Glasgow Gas Commissioners acquired the Pollokshaws Gas-Works, and carried them on for some time. As the Burgh Commissioners are desirous of effecting certain street and other improvements, they lately proposed to the Corporation to buy the site, which extends to about 3784 square yards. An arrangement has now been come to for its sale, subject to the approval of the Corporation and the Commissioners, at the price of 6s. 8d. per square yard; the Corporation to have the option of purchasing from the owner of adjoining property some 12,034 square yards of land at the south-east and north-west extremities of the ground, at 3s. 4d. per square yard, and the right of removing the buildings, gasholders, and other erections thereto. It is stipulated that the Commissioners and the landowner shall, if required by the Corporation, assist the latter in obtaining the necessary consents for the use of the new site for the erection of gasholders.

A new water supply for the town of Laurencekirk was turned on last Saturday by Sir John Gladstone, of Fasque, a nephew of the late distinguished statesman. A year ago the water supply was down to 7 gallons per head per day. The new supply has been brought in since then. It is derived from springs at Phesdo, in the Grampian Hills, a distance of six miles. Besides a storage reservoir, a line of main pipe, 6 inches in diameter, has been laid; and the whole cost has been only £3350. The yield of water is 135,000 gallons per day, which is equal to a supply of about 90 gallons per head. The Engineer was Mr. J. Jenkins, of Messrs. Marr and Jenkins, of Aberdeen.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 4.

Sulphate of Ammonia.—The market is still on the downward grade; and the closing quotations are £10 12s. 6d. to £10 15s. per ton, delivered f.o.b. at the ports. Production goes on increasing; and the quantity offered has only been disposed of at declining prices. Business has also been done at current prompt rates up to the end of the year. Inquiry has, however, been more for delivery over the spring months; but, in this position, producers, for the most part, require £11 per ton or the equivalent, while buyers' views are not much beyond prompt values. Hence only a moderate business has resulted, and this has been mainly speculative.

Nitrate of Soda is firmer at 7s. 10½d. per cwt. for good, up to 8s. for refined, quality, on spot.

LONDON, *Nov.* 4.

Tar Products.—Carbolic acid is scarce and increasing in value. It is stated that this product is now being largely taken up for explosive purposes. Benzols are more inquired after, and may be said to be slightly firmer, though not appreciably dearer. Pitch is moving off freely, with a tendency to better value, although the higher freights now having to be paid are interfering with pitch sales as well as deliveries. There is no change in oils or in naphthas; and anthracene continues uninteresting.

The following may be taken as the average quotations during the week: Tar, 16s. 6d. to 25s. 6d. Pitch, east coast, 33s. to 34s.; west coast, 32s. Benzols, 90's, 9d.; 50's, 10d. Toluol, 90 per cent, 1s. 2½d.; pure, 2s. Solvent naphtha, 1s. 2d. Heavy naphtha, 1s. 2½d. Crude, 30 per cent., naphtha, 4½d. Creosote, 3½d. Heavy oils, 6½s. to 7½s. Carbolic acid, 60's, 2s. 4d.; 75's, 2s. 10d. Crude naphthalene, 55s. Anthracene, nominal, "A," 3½d.; "B," 2½d.

Sulphate of Ammonia.—This market continues weak; and buyers are holding off, expecting even lower prices. There are no important stocks anywhere; and it is curious that values should decline under the circumstances. The business of the week has been done at an average price of about £10 12s. 6d. per ton, less 3½ per cent. at all ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position throughout the coal trade here remains practically unchanged since last week, all descriptions of fuel, except the better qualities of round coal for house-fire purposes, continuing in pressing request, with a shortness of supplies and prices tending upwards, especially for forward delivery. The West Lancashire coalowners have had under consideration a further upward move in list rates; but as the leading Manchester collieries have not altered their quotations, the matter is for the present held in abeyance, with a view of securing united action for a general advance at an early date. For house-fire qualities, pit prices remain exceedingly firm at 12s. 6d. to

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1111.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	21½—22½	..	4 13 4
100,000	10	,,	7½	Do. 7 p. c.	15—16	..	4 13 9
100,000	100	July 3	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 12	6	Bombay, Ltd.	6—6½	..	4 12 3
40,000	5	,,	6	Do. New, £4 paid	4½—4⅝	..	5 1 1
880,000	Stk.	Aug. 16	12	Brentford Consolidated	277—282	..	4 5 1
270,000	,,	,,	9	Do. New	310—315	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	June 15	4	Do. 4 p. c. Deb.	126—130	..	3 1 7
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	255—265	..	4 6 9
226,320	,,	,,	8½	Do. A. Ord. Stk.	187—192	..	4 8 7
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43—45	..	4 8 11
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 3
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9½—10	..	6 0 0
220,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13¾—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	56—58*	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	308—313	−2	4 6 3
200,750	,,	,,	10½	Do. New do.	240—245	..	4 5 9
200,750	,,	June 15	4½	Do. 4½ p. c. Deb.	143—148	..	3 0 10
600,000	Stk.	June 15	10	Continental Union, Ltd.	183—187	..	5 7 0
200,000	,,	,,	7	Do. 7 p. c. Pref.	182—187	..	3 14 10
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	132—137	..	3 16 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	21½—22½	..	4 17 9
354,060	10	,,	11	Do. £7 10s. paid	15½—16½	..	5 0 0
14,993,075	Stk.	Aug. 16	4⅜	Gas-light & Coke	4 p. c. Ord.	105—107	..	4 11 7
2,600,000	,,	,,	3½		3½ p. c. max.	97—99	..	3 10 8
3,799,735	,,	,,	4		4 p. c. Con. Pref.	121—124	..	3 4 6
3,993,975	,,	June 15	3		3 p. c. Con. Deb.	99—101	..	2 19 5
70,000	10	May 31	8	Hongkong & China, Ltd.	14—15	..	5 6 8
3,800,000	Stk.	May 12	10	Imperial Continental	220—225	..	4 8 11
473,600	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—104	..	3 7 4
75,000	5	June 15	6	Malta & Medn., Ltd.	5—5⅛	..	5 9 1
560,000	100	Oct. 2	5	Met. of	5 p. c. Deb.	110—114	..	4 7 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	108—110	..	4 1 10
541,920	20	May 31	5	Monte Video, Ltd.		10¾—11½	..	8 14 0
617,946	Stk.	Aug. 31	9½	Newc'tle & Gateshd Con.		225—230	..	4 0 5
264,855	Stk.	June 29	3½	Do. 3½ p. c. Deb.		106—109	..	3 4 3
60,000	5	Sept. 29	7	Ottoman, Ltd.		5⅛—5⅜	..	6 1 9

*Ex div.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	May 31	8	Oriental, Ltd.	7⅞—8	..	5 0 0
135,000	5	,,	8	Do. New, £4 10s. pd.	6⅞—7	..	5 14 3
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1⅝	..	4 11 5
500,000	100	June 1	6	People's Gas of Chicago	2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	11—11½	..	6 1 9
250,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	7 8 2
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	247—249	..	4 0 4
209,053	,,	,,	10	Do. B.	247—249	..	4 0 4
447,427	,,	,,	10	Do. C.	247—249	..	4 0 4
5,600,000	Stk.	Aug. 16	5⅓	South Metrop., 4 p.c. Ord.	137—140	..	3 16 1
1,520,000	,,	July 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
120,000	Stk.	Aug. 31	6	Tottenham and Edmonton	A. 5 p.c. B. 3½ p.c. 4 p.c. Deb.	141—143	..	4 3 11
250,520	,,	,,	4½			102-104	..	4 6 6
55,100	,,	—	4			115—120	..	3 6 8
182,380	10	June 15	5	Tuscan, Ltd.		9—10	..	5 0 0
149,900	10	July 3	5	Do. 5 p. c. Deb. Red.		98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	June 29	11	Chelsea, Ord.		313—318	..	3 9 2
150,000	,,	,,	5	Do. 5 p. c. Pref.		163—168	..	2 19 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75		145—150	..	3 0 0
175,785	,,	Sept. 29	4½	Do. 4½ p. c. Deb.		150—155	..	2 18 1
1,720,560	Stk.	Oct. 13	7	East London, Ord.		203—208	..	3 7 4
654,740	,,	June 29	4½	Do. 4½ p. c. Deb.		152—157	..	2 17 4
390,000	,,	,,	3	Do. 3 p. c. Deb.		101—103	..	2 18 3
700,000	50	June 15	7½	Grand Junction	10 p. c. max. 4 p. c. Deb.	109—112	..	3 7 0
310,000	Stk.	Sept. 29	4			133—138	..	2 18 0
708,000	Stk.	Aug. 16	14	Kent		350—355	..	3 18 11
160,000	,,	,,	7	Do. New, 7 p. c. max.		208—213	..	3 5 9
1,043,800	100	June 29	10½	Lambeth, 10 p. c. max.		293—298	−2	3 10 6
406,200	100	,,	8	Do. 7½ p. c. max.		225—230	..	3 9 7
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.		136—140	..	2 17 2
500,000	100	Aug. 16	12½	New River, New Shares		428—433	−2	3 2 4
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.		135—140	..	2 17 2
902,300	Stk.	June 15	7½	South-wark and Vauxhall	Ord. 7½ p. c. max. 5 p. c. Pref. 4 p. c. A Deb.	210—215	..	3 9 9
126,500	100	,,	7½			193—198	..	3 15 9
489,200	Stk.	,,	5			165—170	..	2 18 10
1,019,585	,,	Oct. 13	4			131—136	..	2 18 10
1,155,066	Stk.	June 15	10	West Middlesex		298—303	..	3 6 0
200,000	,,	,,	4½	Do. 4½ p. c. Deb.		152—157	..	2 17 4
200,000	,,	Sept. 15	3	Do. 3 p. c. Deb.		101—103	..	2 18 3

13s. 6d. per ton for best Wigan Arley, 11s. to 11s. 6d. for Pemberton four-feet and seconds Arley, and 10s. 6d. for common house coal. Good qualities of steam and forge coal are now fetching from 10s. to 10s. 6d. per ton, with engine fuel quoted at from 6s. to 6s. 3d. for the lowest qualities, 6s. 6d. to 6s. 9d. for medium, and 7s. 3d. to 7s. 6d. for best slacks. On forward contracts, advances of 3d. to 6d. per ton upon these prices for engine fuel are being quoted generally; and in some instances 8s. has been obtained for best slack for delivery into next year. Shipping is fairly brisk; and with only limited supplies offering at the ports, prices continue to harden. From 11s. to 11s. 6d. is now the average figure for steam coal, with the better qualities quoted at from 12s. 6d. to 13s. 6d., delivered at the Mersey ports. The Lancashire makers of foundry coke on Tuesday advanced their list prices 2s. per ton; and furnace cokes have also moved upwards to a similar extent. At the ovens, good foundry cokes are now about 28s. per ton, and furnace qualities 22s.

Northern Coal Trade.—The demand for coals is very firm; and there have been some advances in price since last report. Best Northumbrian steam coals are now 11s. 9d. to 12s. per ton f.o.b.; and steam smalls are 7s. to 7s. 6d. The collieries are in full work; and there is a disposition to contract forward at relatively high prices. In the gas coal trade, there is considerable pressure for supplies on contracts; and the quantities being sent out are very heavy. A few more sales have been made for coal over next year's shipping season; and about 12s. per ton is believed to have been paid for export. There is very little free coal now for sale for occasional cargoes; but for such, when obtainable, the price is from 11s. 6d. to 12s. 3d. per ton f.o.b. Gas coke is rather scarcer, and there is a greater variation in rates; but from 14s. to 14s. 6d. per ton f.o.b. may be taken as the medium price for good gas coke.

Scotch Coal Trade.—Trade continues good, with prices showing a tendency to rise, which is a common experience at present. The home demand is great; and there is also a better business for shipping. The prices quoted are: Main 9s. 3d. to 9s. 6d. per ton f.o.b. Glasgow, ell 10s. 6d. to 11s., and splint 10s. 6d. to 11s. The shipments for the week amounted to 175,527 tons—a decrease of 5124 tons upon the previous week, and of 2600 tons upon the corresponding week of last year. For the year to date, the total shipments have been 7,260,205 tons—a decrease of 967,408 tons upon the same period of last year.

Gas Supply in Buenos Ayres.—The Buenos Ayres Correspondent of the "Chemical Trade Journal," who furnished some information on the above subject which appeared in the "JOURNAL" for the 24th ult. (p. 1014), writes to the above-named publication to the effect that at a recent extraordinary general meeting of shareholders of the Primitiva Gas Company, it was resolved to sell the undertaking to an English Syndicate, and shareholders were advised that they must decide whether they would take £10 in cash or preferred shares. This selling of the concern, he says, is a very good move on the part of the shareholders, as it will provide more capital to carry on the extension works which are so much needed, especially in the electric light section, in view of the competition of the other companies.

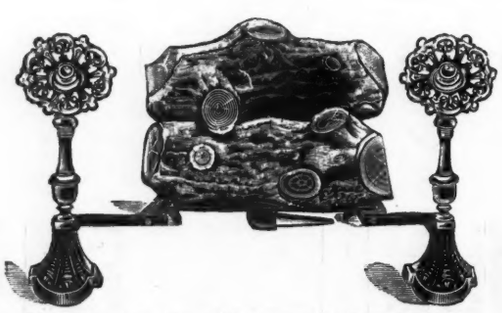
Subways in the City of London.—At the meeting of the Court of Common Council of the City of London last Thursday, it was decided to apply to Parliament for powers to enable the Corporation to make provision for the accommodation of pipes, wires, and cables under the public thoroughfares.

Alleged Unhealthiness of the Sowerby Bridge Gas-Works.—We learn from a Bradford paper that the Chairman of the Gas Committee of the Sowerby Bridge District Council (Mr. J. W. Lodge) has intimated his intention of resigning this position, because the works are so ill-ventilated as to cause complaints on the part of the men. He thinks they should all join the Gas Workers' Union; and he has offered to take the chair if the local Secretary of the Union will call a meeting on the matter.

Additions to the Plant of the Slough Gas Company.—In the report which the Directors of the Slough Gas Company presented at the meeting of the shareholders last Wednesday, they stated that the erection of a new gasholder, with steel tank, of the capacity of 100,000 cubic feet, had been completed, and connected with the existing works by a 12-inch main through the principal street of the town, which main will eventually be used in place of the existing small mains for the distribution of gas. This provision will enable the Company to meet the increasing demand for gas in the district both for lighting and cooking purposes.

The Durham Coal Trade Conciliation Board.—The first meeting of the recently formed Conciliation Board in the Durham coal trade was held at Newcastle-on-Tyne last Saturday. Sir David Dale was appointed Chairman, Mr. W. H. Lambton Vice-Chairman, and Mr. Reginald Guthrie and Mr. John Wilson, M.P., Secretaries, representing respectively the colliery-owners and the workmen. It was unanimously resolved to ask Lord Davey to accept the position of Umpire. At the close of the ordinary business, a special meeting was held to consider an application of the miners for an advance; and it was agreed that the wages be increased 3¾ per cent.—being 33⅓ above the basis. The advance came into operation yesterday.

The End of the Eastern Counties Coal Boring and Development Association.—Our readers will probably recollect the circumstances under which, a few years ago, the Eastern Counties Coal Boring and Development Association was founded, and the result of their labours. These were so unsuccessful that the extinction of the Association is now imminent. A meeting of the members was held at Ipswich last Tuesday, at which the Liquidators presented a statement of accounts which showed that they had £1318 18s. available for distribution among the shareholders. This is equivalent to a return of 5s. 6d. per share on the 4795 shares subscribed for. The accounts were approved; and the 5s. 6d. per share will be shortly distributed. The books and accounts of the Association will be retained in hand for another three months, and will then be destroyed. It is not considered probable that any further attempt will be made to test the carboniferous resources of East Anglia, for another generation at any rate.



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Kingsbridge Water Supply.—A further report on the scheme for obtaining water from Place Moor was submitted to the Kingsbridge Urban District Council last Wednesday by Messrs. Taylor, Sons, and Santo Crimp, the Engineers. They recommended that a masonry dam be constructed across the valley, at a point somewhat lower than was first suggested, and to enlarge the capacity of the reservoir from 9 to 14 million gallons. This would add £1400 to the cost. Seven acres of land would have to be acquired; and a 6-inch main laid from the storage to the service reservoir, which should be built at a high elevation about a mile from the town. The cost was estimated at £10,900, or £13,250 including new mains and hydrants in the town. It was decided to apply for a Provisional Order to authorize the carrying out of the scheme.

Gas and Water Matters at Carlisle.—At last Thursday's meeting of the Carlisle Town Council, the Gas Committee reported that official sanction of the Local Government Board had been granted to the borrowing of the sum of £17,000 (being the balance of the sum of £25,000 authorized by their Provisional Order of 1893) for the purposes of gas supply—repayable in 18 years from the date of borrowing; and the Committee had passed a resolution requesting the Finance Committee to provide them with £12,000 of the amount as early as convenient. The Local Government Board had also sanctioned the borrowing of £2920 for works of water supply—repayable in 27 years; and the Water Committee had passed a resolution requesting the Finance Committee to provide the money as early as convenient. Mr. Corbett explained that the gas loan referred to was for work done on the streets—such as the laying of mains and branch mains since 1896, for lamps which had been put up, and for future extensions. The question of the abolition of the gas-meter rents had been discussed by the Committee; but they still found it necessary to obtain further information. When they had this information, they would be able to present a definite report on the subject to the Council.

The Brewers' Exhibition.—There was very little novelty, as far as gas appliances were concerned, at the above exhibition, which was held in the Agricultural Hall, Islington, from the 28th ult. till Friday last. Gas-engines were shown by Messrs. Crossley Bros. and the National Gas-Engine Company, Limited; and there were several "Stockports" in use for driving machinery. The Water-Motor and Automatic Liquid Elevator Company, Limited, of which Mr. J. Keith is the Managing-Director, had a good show, including their automatic gas-compressors for high-pressure incandescent gas lighting. Messrs. Ewart and Son had a stand of baths, geysers, &c., and Mr. G. F. Zimmer had again on view his vibrating conveyor, described in our notice of last year's exhibition. The Eagle Range and Gas-Stove Company, Limited (late Messrs. Arden Hill and Co.), showed their latest master-patent "Acme" stoves, &c. As usual, the Incandescent Gas-Light Company, Limited, dazzled the visitors to the exhibition by the brilliancy of their stall at the end of the arcade leading to the hall from the Islington Green entrance. Another brilliant stand was that of Messrs. S. Clark and Co., in the gallery, where they had on view a good collection of their "Syphon" flueless gas heating-stoves, gas and oil bar-stoves, and gas mullers.

Proposed Purchase of the Exmouth Water-Works by the District Council.—At a meeting of the Exmouth District Council last Wednesday, it was decided to promote a Bill next session for the purchase of the undertaking of the Exmouth and District Water Company. It was also decided to oppose a Bill which the Company are promoting with the object of raising additional capital. It was contended that, if the water-works were purchased at a fair price, the ratepayers would eventually get a good return on the outlay. Some of the members, however, objected to the scheme, on the ground that it would result in an addition to the rates, which one of them estimated at 1s. in the pound. Ten members voted for, and three against the resolution; five being neutral.

The Recent Irregularities in the Stafford Corporation Gas Department.—It is almost time the agitation raised over the irregularities discovered some time since to exist in the Stafford Corporation Gas and Electricity Department was allowed to subside. But further reference to the matter was made at last Tuesday's meeting of the Town Council, when the General Purposes Committee reported the receipt of the following minute from the Gas Committee: "That the conduct of the officials under their jurisdiction, with the exception of those who have already been dealt with by the Committee, has during the past year been satisfactory." This report gave rise to a long and heated discussion; several amendments being moved with the view (1) to show that all officials of the Electricity Department had conducted themselves satisfactorily; (2) that the names of those in the Gas Department who had, in the opinion of the Committee, conducted themselves satisfactorily should be given; and (3) that the paragraph should be referred back to the Gas Committee for a more explicit report. All of them were, however, lost by overwhelming majorities, on being put to the vote; and the report was adopted.

A Water Scheme for Rugby.—Acting on the instructions of the Rugby District Council, Mr. Charles Hawksley has presented a report on the future water supply of the town. Having regard to the rapid progress of recent years, he assumes that in another twenty years the population will be 30,000, and says a supply of 20 gallons per head per day ought to be ample. This, in the course of twenty years, would mean an average daily supply of 600,000 gallons, or the equivalent to a maximum supply at the height of summer of about 720,000 gallons per day. He did not think there were sufficient grounds for suggesting the abandonment of the River Avon as the source of supply; and this should provide ample water to meet the requirements of Rugby for many years to come. It was essential, however, that the water should be efficiently filtered, and an additional subsiding or storage tank be constructed. He suggests, therefore, the cleaning of the Brownsover Mill dam, the laying of a pipe from the dam to the suction-well at the Avon pumping-station, the construction of a storage tank to contain not less than a million gallons, the laying down of two additional filter-beds, each having an area of 500 square yards, and the covering of the clear-water tank. He estimates the work can be carried out for £12,000. Before calling in Mr. Hawksley, the Council anticipated an expenditure of £30,000. It has been decided to act on his suggestions.

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Society of Arts.—The 146th session of this Society will open on the 15th inst. with an address from the Chairman of the Council, Sir John Wolfe Barry, K.C.B., F.R.S. It is expected to be a development of the subject of "London Communications," dealt with by him last session, with suggestions as to the practical means of carrying his proposals into effect. Among the papers to be read after Christmas is one by Professor W. Boyd Dawkins, M.A., F.R.S., on "Coal in South-Eastern England;" and next May a course of Cantor Lectures will be delivered by Major Philip Cardew, R.E., on "The Control, Regulation, and Measurement of the Supply of Electrical Energy."

Differential Water Charges.—There has been some correspondence in a local paper with reference to the water charges in the Shipley district; and an allusion to the matter at the meeting of the District Council last Tuesday, brought out an interesting point in connection with the question of differential charges. For many years, it was stated, a Saltaire firm had paid £1000 per annum for water; and if the town had not received this income, the rates would have been about 4d. in the pound more. The bargain was made with the firm nineteen years ago; and they were charged only 3½d. per 1000 gallons. It was certainly not a matter of favouritism that the firm were charged this low price, as they have shown that they can provide a supply at a much cheaper rate—in fact, they are doing so now at a total expense of something like £250 a year.

The River Plate Gas Company and the Rosario Gas-Works.—An extraordinary general meeting of this Company was held on Monday last week, at Winchester House, E.C.—Mr. A. E. Brown presiding—for the purpose of considering an *ad referendum* arrangement entered into by the Directors with Mr. Antonio Santa Maria, for the purchase by the Company of the gas-works and their appurtenances in the city of Rosario. The Chairman explained that the Board had obtained an option, which expired the next day, to purchase the works for £180,000 in cash. Negotiations on the subject had been going on for several months; but it was only on the 28th of September that the vendor finally consented to give the option. The concession for the works was in perpetuity; and the land on which they were built was freehold. The city had a population of 90,000. On Dec. 31 last there were 2225 meters in use; and there were 61,887 metres (about 68,000 yards) of mains laid. The quantity of gas produced in 1897 was 66 million cubic feet, and 72 million cubic feet in 1898; while during the first four months of the present year—the latest date to which they had particulars—there was a further increase of 10 per cent. over the corresponding period of last year. There was an Electric Light Company in Rosario; but it did not appear to have made much progress. The present owners of the gas-works had a contract, which had seven years to run, with the Municipality; and it would be handed over to this Company if the purchase were completed. It was believed that if the Company acquired the works, it would be possible to considerably increase the output of gas and to conduct the business very economically. The average profits for the past three years had been £16,032 per annum, those for 1898 having been £19,964. He concluded by moving a resolution in accordance with the object of the meeting; and it was carried unanimously.

The Incandescent Mantle Remover Company, Limited, has been formed with a capital of £500, in £1 shares, to adopt an agreement with one Woolf, and to acquire and work patents.

Fatal Explosion of Acetylene.—We learn from the "Cape Argus" of the 5th ult. that a shocking fatal accident occurred in Cape Town on that day. Mr. Guy Dart, of the firm of Messrs. Dart and Co., was experimenting with an acetylene gas-machine, when it exploded, and inflicted such terrible injuries upon his head that death resulted instantly. The effect of the explosion was to cut the deceased's head and face completely in half in a longitudinal direction. It seems that the deceased was unfamiliar with the machine.

Lambeth Water-Works Company.—The Directors of this Company have decided, subject to audit, to transfer £7000 to the contingency fund, and to recommend the payment of a dividend for the past half year at the prescribed rates of 10 and 7½ per cent. per annum respectively on the share capital of the Company, together with a further payment at the rate of ½ per cent. per annum on both classes of shares on account of arrears of previous dividends; leaving a balance of about £7900 to be carried forward, after making provision for the statutory payment to the sinking fund.

Cardiff Gas-Works Purchase.—The Special Committee of fifteen members appointed by the Cardiff Corporation to reopen negotiations with the Gas Company, with a view to the acquisition of their undertaking, had a preliminary meeting on Monday last week. The Mayor (Sir T. Morel) was voted to the chair. At the outset, Mr. Symonds remarked that, in the General Purposes Committee, Alderman Trounce had said that the Company wanted a price based upon 27 years' purchase of the profits of the previous half year; and he asked if this was true. The Mayor mentioned that the Chairman of the Company had told him that, if the Corporation were prepared to renew negotiations pretty well on the same terms where they left off nine years ago, the Directors would be prepared to consider the matter. Alderman David Jones thought their first duty was to find out whether the Company were prepared to enter into negotiations for the sale of their works. He moved that a letter be addressed to the Company to ascertain this. The proposal having been seconded, a suggestion was made that the motion be enlarged by asking the Company to name the figure at which they were willing to sell their works. With this extension, the motion was carried. In the course of further discussion, the Mayor stated that he calculated the amount of the purchase-money, giving the shareholders Corporation 3 per cent. stock, would be £905,000, upon which Mr. Brain remarked that the market value was £650,000. Mr. Symonds was of opinion that the price quoted by the Mayor was a quarter-of-a-million sterling in excess of the present value of the gas-works. Alderman Jones said, if they took compulsory powers, they would have first to ascertain the market value of the undertaking, and then add 10 per cent. as compensation for compulsory acquisition. Mr. Symonds: That would bring up the purchase-money to only £715,000. After these speculative shots at the price the Corporation will be required to pay, it was agreed to have the Company's balance-sheets extending over a number of years reprinted for circulation among the Committee.

The "CZARINA."

Season 1899.

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Gas Affairs at Fenton.—A meeting of the Fenton District Council was held last Tuesday when the minutes were confirmed of a special meeting at which it was resolved that application be made to the Local Government Board for a Provisional Order amending the Stoke-on-Trent and Fenton Gas Acts, 1878 and 1883, and empowering the Council to borrow further sums of money not exceeding £15,000 in addition to the £65,000, the aggregate amount which they are authorized to borrow under the said Acts. The Gas Committee recommended that Mr. F. H. Darwin's resignation as Manager and Secretary of the gas-works be accepted; that the work of Manager and Secretary be divided into two distinct offices, with salaries of £200 and £120 a year respectively; that Mr. H. J. Crutchley be appointed to the office of Secretary to the Gas Committee; and that a Manager for the gas-works be advertised for. These various resolutions were agreed to, and the advertisement referred to in the last one appears in our columns for the second time to-day.

Consolidation of Gas Companies in Buffalo.—Arrangements have been made, according to "Progressive Age," for the consolidation of several gas undertakings in Buffalo. The new concern will be known as the Buffalo Gas Company. It will be capitalized at $9,000,000, of which $2,000,000 will be 6 per cent. non-cumulative preferred stock and $7,000,000 common stock. In addition to the stock, there will be $7,000,000 of bonds bearing 5 per cent. interest. Of these $5,900,000 will be used to retire an equal amount of bonds of the Buffalo City Gas Company, and the remaining $1,100,000 will be issued for improvements. The new Company will take over the Buffalo Gaslight Company, the Buffalo City Gas Company, and the Mutual Gas Company. The People's Gaslight and Coke Company (the Addicks Company) will remain separate for the present, but will be controlled by the new Company, who own 90 per cent. of their bonds and stock. One of the Directors of the Company is Mr. A. C. Humphreys, of Messrs. Humphreys and Glasgow.

Sales of Shares.—Last Tuesday, Messrs. Hollis and Webb, of Leeds, sold 20 ordinary shares in the Aberystwyth Gas Company at £15 each. On the following day, Mr. R. Mack sold, at the offices of the Newcastle and Gateshead Gas Company, in accordance with the announcement which appeared in our columns, £28,500 of the Company's 5 per cent. preference stock, being additional capital required for the extension of the plant, and for the new works at St. Anthony's. The stock was disposed of in about forty minutes, at prices ranging from £140 10s. to £145 10s. per £100 of stock. The total sum realized was £40,848; being an average of £143 6s. 6½d. At Wrexham, last Friday, Messrs. Jones and Son sold by auction £1300 of consolidated stock of the Wrexham Water Company, by order of the Trustee of the late Mr. W. Overton, at prices ranging from £185 to £191 per £100 of stock; £800 of 4½ per cent. preference stock, at £136 to £137 10s. per £100; some £10 "A" 5 per cent. preference shares, in lots of ten, at £150 10s. per lot—two odd shares fetching £32; and some ordinary £10 shares, carrying £4 11s. per cent. dividend, in lots of ten, at £140 per lot. On the same day, Mr. Dacre sold by auction 138 £20 shares in the Otley Gas Company, at prices ranging from £33 5s. to £35 each.

Barrow Water Scheme.—With reference to the scheme for increasing the water supply of Barrow by tapping the River Duddon, the Town Council have arrived at the conclusion that it is not desirable to apply for powers in the ensuing session of Parliament. It is understood that the Bill has been deferred in order that the various landowners and the lords of the manors may be approached, and arrangements made with them for the purchase of land and adjustment of rights.

Fatal Accident at the Manchester (Rochdale Road) Gas-Works.—The Deputy-Coroner for Manchester, Mr. L. J. Aitken, held an inquest last Thursday on the body of Andrew Cavanagh, aged 31. The deceased, who was employed as a labourer at the Rochdale Road Gas-Works, was on the previous Saturday evening assisting to empty some railway waggons at the works, when, it appears, he fell into a hole under the railway line, a depth of several feet. From the injuries sustained, he died at the Royal Infirmary on Tuesday. The Jury returned a verdict of "Accidental death."

Barnoldswick Gas and Water Supply.—The Clerk to the Barnoldswick District Council (Mr. C. Thornton) has just compiled an interesting year-book for the use of the members, in which he gives a complete financial statement for the year ending March 31 last. The total revenue amounts to £11,129, and the expenditure to £8966. At the gas-works during the year, 17½ million cubic feet of gas were made; and the coal carbonized amounted to 1770 tons—an average of nearly 10,000 cubic feet of gas per ton. Nearly 13 million cubic feet were sold for lighting purposes, and 3½ millions for cooking, heating, and motive power. The price per 1000 feet was 3s. 6d. for lighting, and 3s. for cooking, &c. The works are equal to a maximum daily production of 112,000 cubic feet; but it is hoped to increase this by from 50 to 75 per cent. when all the new settings are completed. A succinct history of the water-works is given. The works were begun and completed in 1891; the total cost being estimated at not less than £10,000. The capacity of the reservoir is 432,525 gallons; and in 1889 the yield of water in 24 hours was about 180,000 gallons.

Birmingham Gas Workers and the Reservists.—We find that the suggestion thrown out by a correspondent with reference to the maintenance of the families of Reservists drawn from gas and water works out of a fund raised by their fellow-workmen (see *ante*, p. 997) had been anticipated by the employees at the Windsor Street Gas-Works, Birmingham, who, a few days prior to the publication of the suggestion, had held a meeting, under the presidency of Mr. Charles Hunt, at which it was unanimously decided to create such a fund, each employee contributing 1d. per week thereto. The Workmen's Benevolent Fund Committee were deputed to receive and allocate the proceeds of the Reservists Fund, the distribution of which it was arranged should, as far as practicable, be in the proportion of 6s. per week for a wife or one other dependent, *plus* 1s. per week for each child. It was announced that the above-named Committee had voted £5 as the base of the fund; and their action was heartily approved by the men. Further support was also promised by the Chairman. The action of the Corporation Gas Committee in regard to the Reservists in their service was noticed last week.

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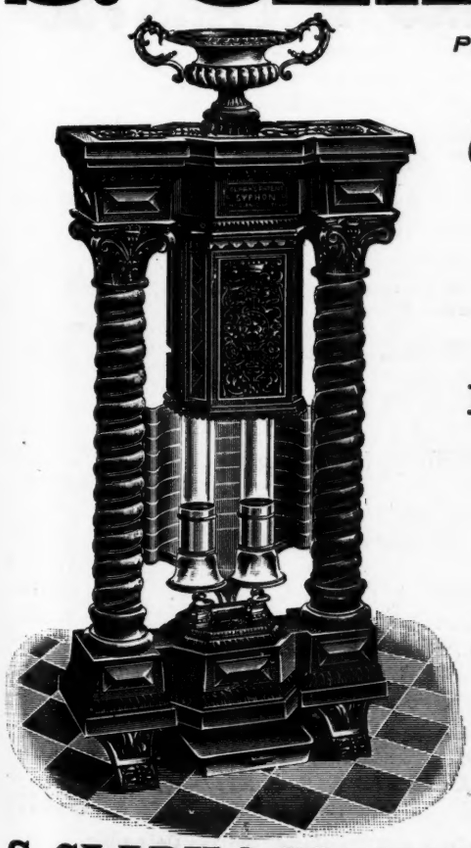

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Bursting of a Large Water-Main at Manchester.—A large water-main burst last Sunday week in the Hyde Road, Manchester, and caused considerable damage to property. The pavement was suddenly thrown up with a loud report, a dense volume of water poured forth, and for a distance of a few hundred yards the street had soon the appearance of a running stream. Probably the water reached a depth of nearly 2 feet in most places; and the lower portions of some of the surrounding property were quickly flooded. Officials of the Water Department were promptly informed of the facts, and took steps to cut off the supply in the immediate neighbourhood. In about an hour and a half after the outbreak, the chief danger from the flow of water was averted; and Corporation workmen set themselves to locating the fracture and mending the pipe. They worked expeditiously; and by about noon on Monday the defect was made good. The actual fracture in the main was something like a yard long, and only a few inches wide. The metal had been forced out to this extent, and the piece was missing. The main had been in use about 16 years.

The Waste of Water at Epsom.—At the meeting of the Epsom Urban District Council last Wednesday, their Consulting Engineer—Mr. W. V. Graham—reported that, in conjunction with Mr. C. P. King, the Council's Engineer, he had been considering the matter of the waste of water in the town, which had been referred to him (*ante*, p. 612). He had measured the quantity which ran to waste under the head of the new reservoir, and found that on the night of the 21st ult. the total per hour worked out to 3·25 gallons per head of the population. He said it was scarcely necessary for him to point out that these figures were nothing less than astounding. His observations showed that every day during the one hour in the morning when he understood the district was upon the new reservoir, enough water was wasted to abundantly supply 1000 people for the whole day. Making every deduction, therefore, which could fairly be made for the low head at which they supplied the district with water, and the intermittent character of the supply, he had no doubt whatever that more than half of the water raised from the wells was absolutely wasted. Steps could be immediately taken to detect the waste, from whatever cause it sprang—whether from broken mains, bad joints, leaky service-pipes, or bad fittings. It could all be found and stopped; but it was a work which could not be finished once and for all. Deterioration of the material employed in delivering water to the consumer was always going on; and it was the business of a water-supplying authority to keep pace with this deterioration. Although the condition of things at Epsom was very bad, it was not without precedent; but he had no hesitation in promising that if the Council would vigorously undertake the work he had indicated, in the course of a few months—possibly by next summer—Epsom would be in the enjoyment of a constant supply of water. He concluded by acknowledging the assistance he had received from Mr. King, and said it was only fair to that gentleman to remind the Council that upon former occasions he had—perhaps less strongly, because upon less accurate information—given them the same advice that he (Mr. Graham) was now doing. The Council considered the report in Committee, and decided to request Mr. Graham to attend a meeting of the Water Committee.

Haydon Bridge Water Supply.—The Hexham Rural District Council at their last meeting decided to adopt the scheme of water supply for Haydon Bridge prepared by Mr. H. W. Taylor. The water will be obtained from copious springs issuing from the gritstone measures, and will gravitate to a concrete service reservoir holding 70,000 gallons, and from thence by distributing mains throughout the village. The total length of mains is about seven miles; and the cost of the whole scheme is £3700.

Water Scheme for Otley.—At a meeting of the Otley District Council last Thursday week, it was decided to promote a Bill next session for the purpose of obtaining a water supply for the town. A previous Bill introduced by the Council for impounding Bow Beck, near Ilkley, on the north side of the Wharfe, was unsuccessful. It is now proposed that the Engineer of a smaller scheme (Mr. John Waugh) to impound March Ghyll, and Mr. Stansfield, who recommends Scales Ghyll, shall submit their schemes to Mr. James Mansergh, and that his opinion shall be accepted by the Council. The former scheme was to cost £70,000; but either of the two last mentioned will come to much less, and will provide an ample supply of water for the town for some time to come.

The Chairman of the Thames Conservancy on the London Water Supply.—At the meeting of the Middlesex County Council last Thursday week, Sir F. Dixon-Hartland, who is the representative of the Council on the Thames Conservancy, of which he is Chairman, presented his quarterly report. After referring to the past season, he said: "By means of the system of intercommunication between the Water Companies, the Thames is capable of supplying the needs of London; and when once the system of reservoirs sanctioned by Parliament is in working order, all pretence of saddling London with the enormous cost of bringing water from Wales, will be absolutely unnecessary; thus getting rid of the question of the London County Council interfering with the water supply of Middlesex, which has so long and successfully been opposed by the county.

Paignton Water Supply.—It was unanimously decided by the Paignton District Council last Wednesday to promote a Bill in the ensuing session for the improvement of the water supply. Dr. Vickers, the Medical Officer of Health, reported that the land which it was proposed to acquire was an open stretch of Dartmoor, from 900 to 1700 feet above sea-level. It had not a single human dwelling upon it, or any cultivated land whatever. Mr. Puddicombe, in moving the resolution authorizing the application to Parliament, stated that the proposed gathering-ground comprised about 700 acres, and the price to be paid for it was £11 per acre. It was impossible to obtain an adequate supply in the neighbourhood of Paignton, and it was better to go in for a big scheme which would meet all their wants for years to come. It was stated by the Chairman of the Council that the negotiations with the Torquay Corporation failed because they could only supply 50,000 gallons a day, which was inadequate. Then the charge was to be 1s. 8d. per 1000 gallons, less 40 per cent.; whereas their own cost only worked out to 7d. per 1000 gallons. The present scheme would be a great benefit to the town, and enable them to carry out building operations on the higher levels.

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WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000 000	COLCHESTER (Second Contract)	300,000
HALIFAX	1,000,000	YORK	750,000
TORONTO	250,000	ROCHESTER	500,000
OTTAWA	250,000	KINGSTON, ONT.,	300,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000
MONTREAL	500,000	DULUTH, MINN.	300,000
TORONTO (Second Contract; Remodelled)	2,000,000	CATERHAM	150,000
BELLEVILLE	250,000	LEICESTER	2,000,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000
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And Additional Work, including complete Gas-Works at Nelson and Rossland, British Columbia.

The Torrington Corporation and the Water-Works.—After considerable delay and difficulty, the Torrington Corporation have decided to buy the undertaking of the Torrington Water Company, and proceed with the execution of works for extending the supply. The estimated cost of the scheme is £13,000.

County Councils and the Preservation of Water Supplies.—The report which the Health and Sanitary Committee presented at the meeting of the Nottinghamshire County Council last Tuesday, pointed out that the passing through Parliament of the Derwent Water Bill, and the evidence then given, had brought out prominently the present inability of county authorities to protect and preserve the water supply within their own limits. The county, it was stated, was supplied in great measure from sand-beds which overlie a valuable coal-field; and if these waters were permanently run to waste in winning the coal, large surrounding areas must be drained and the population suffer severe loss. The Committee were glad to learn that the question was receiving the serious attention of the County Councils' Association. A Sub-Committee had already been appointed to collect information, and the Committee were confident that the Council would readily afford the Association all the assistance in their power in dealing with the matter. Mr. Tylden-Wright moved the adoption of the report; stating that the discussion on the Derwent Water Bill brought out clearly and prominently the unsatisfactory position of the law as regards water rights. Therefore the Committee appointed a strong Sub-Committee to see what steps could be taken to put it on a more satisfactory basis in regard to the rights of the public in the water of the Derwent. It was pointed out when the matter was before the House of Commons that Nottinghamshire had an ample supply of water. This very likely was so when the supply was at their hand; but what was the position? The water-beds lay over a very valuable coal-field; and when mines were sunk, it was probable that the supply would be diminished. There was a case in the north of the county where there were 3 or 4 million gallons of water turned into the River Ryton. This water was of pure quality, and was as good as the city of Nottingham would get from the upper waters of the Derwent. He was told that in the neighbourhood of Worksop springs which had run for over 500 years were now perfectly dry, and that numerous wells had had to be lowered in order to maintain their supplies. In the east of the county, there were two large mining undertakings in contemplation, which would extend between the beds, and naturally lessen the source of supply. He hoped that the County Councils' Association would seek evidence, and obtain a measure that would be satisfactory to them. Among other speakers was Lord Belper, who, being a member of the Sub-Committee appointed by the County Councils' Association, was able to state that their inquiry would extend to the whole water question. The report of the Committee was adopted.

The Conway Corporation have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for a cornish boiler, annular condensers, and purifying plant.

The rules made by the Board of Trade with respect to applications for Licences and Provisional Orders, &c., under section 5 of the Electric Lighting Act, 1882, have been issued from the Stationery Office.

The contract for the supply of 48-inch and 24-inch mains to connect the Granton works with the gasholder station at Canonmills, Edinburgh, has been let to Messrs. D. Y. Stewart and Co., of Glasgow, who were the lowest tenderers.

The Carlisle Corporation Gas Committee have discontinued the insurance of their workmen under the Workmen's Compensation Act, 1897, because—according to a statement of the Chairman—they consider that most of the men do not come within the Act.

The Directors of the Faversham Water Company have replied to a letter from a Special Committee of the Town Council that, if the ratepayers are prepared to purchase the undertaking at an equitable valuation as a going concern, the Company would probably not object to negotiate on that basis.

During the gale last Friday, a large shed, forming part of the tube-works of John Brotherton, Limited, of Wolverhampton, suddenly collapsed; and three of the workmen were more or less seriously injured. The portion of the works wrecked was 50 yards in length. The Manager (Mr. A. J. Lloyd) states that the completion of the orders in hand will not be seriously interrupted by the disaster.

A series of twelve lectures on "Sewage and its Purification" is being delivered at University College, Gower Street, W.C., on Monday evenings at 5.30. In the course thereof, the lecturer—Dr. S. Rideal, F.I.C.—will give a review of the various processes that have been adopted for the treatment of sewage, with special reference to bacterial methods. The lectures are specially intended for persons engaged on sewage farms, and for others connected with the administration of the Public Health Acts. The first lecture was delivered yesterday.

With reference to Mr. Millard's paper on "Governors," read at the recent meeting of the North of England Association of Gas Managers at Newcastle, and to the paragraph relating to it which appeared on p. 1016 of the "JOURNAL" for the 24th ult., we are asked to state that the inventor of the open-end cylindrical valve for gas-governors was Mr. William Key, for many years Superintendent of the Tradeston Gas-Works, Glasgow, who patented it in 1882 (No. 4981). In the same year he disposed of his interest in the patent to Messrs. W. & B. Cowan, who have since illustrated and described it in their catalogues.

Mr. J. T. Westcott, the Manager of the Economical Gas Apparatus Construction Company, Limited, who has just returned from America, reports that he found the American offices of the Company were reaping the benefit of the present unusual prosperity; they having in hand considerable work. Among other contracts may be mentioned a complete works for the Nelson (B.C.) Gas Company—including buildings, mains, services, &c.—of which concern Mr. Westcott has just been elected a Director. The Westminster offices of the Economical Gas Apparatus Construction Company at present have nine different carburetted water-gas plants in hand. These include one for the Continent, one for Buenos Ayres, and one (of a capacity of 1,500,000 cubic feet a day) for the Burnley Corporation. Two of the plants on which the Company are at work have a daily capacity of over 2 million cubic feet. Mr. Westcott has been elected a member of the Institution of Civil Engineers of France.

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Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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[For Illustrated Advertisement, see p. 1154]

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Gives no Back Pressure.
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Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1769.

JOHN RILEY & SONS, Chemical Manufacturers, Hanton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

A NEW Style of Hydraulic Main. No more thick Tar in the Main. Specification and a Photograph of the Machine, and how to make and fit it up, can be obtained from the Inventor for 10s. 6d.
S. CARPENTER, Ryde House, 28, Woodhouse Grove, EAST HAM.

EXAMINATIONS IN GAS MANUFACTURE.
STUDENTS prepared by Correspondence for the next CITY AND GUILDS EXAMINATION by a Gas Manager. First-Class Honours and Silver Medallist.
For Terms, &c., apply, by letter, to No. 3376, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORKING Manager desires a change.
Five Years in present Situation. Age 32. Has a thorough practical knowledge of the routine of a small Gas-Works. Good Carbonizer and Fitter. Can manage Generator Furnaces, Exhausting Machinery, &c.
Please address No. 3377, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Engagement by the Advertiser, a GAS MANAGER, with extensive Home and Colonial experience, who will be disengaged in the early part of the month of October. Well up in all the details of modern Gas-Works Construction and its Management, and the most approved Appliances introduced to economize the production of Gas and extend its use. Practically acquainted with both American and German Carburetted Water-Gas Plant and its manipulation. A good Draughtsman and Accountant. Satisfactory References and Testimonials.
Address No. 3332, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Works Fitter. Young Man.
Must be a good Mechanic, well acquainted with Retort-House Work, and have undeniable References.
Address the MANAGER, Gas-Works, KINGSTON-ON-THAMES.

WANTED, a First-Class Gas-Fitter, accustomed to Iron Pipes and Acetylene Gas preferred.
Apply to the FORBES ACETYLENE GAS COMPANY, Regent Street, KENSAL GREEN, W.

WANTED, a Book-keeper, used to Rental Ledger, Fittings, Stoves, and the routine of a Gas-Works. Salary £65 per annum.
Apply, with *copies* of three Testimonials only, to T. W. R. WHITE, Gas-Works, SHERBORNE.

WANTED, at once, a First-Class DRAUGHTSMAN, well up in designing and estimating Gasholders and Gas Plant of all descriptions.
Address, with *copies* of recent Testimonials, stating Age, Salary required, &c., C. & W. WALKER, LIMITED, Donnington, near Newport, SALOP.

WANTED, by a South Wales Gas Company, a GAS-FITTER. One who is accustomed to Main and Service Laying, and is familiar with searching for and repairing Leakages in Mains and Services and the control of Men.
Apply, stating Wages required, with *copies* of three recent and dated Testimonials, to No. 3378, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SEASON 1899.
BALE'S OXIDE OF IRON, of finest Quality. Summer delivery specially recommended for efficiency and economy.
FIRE CEMENT, PAINT, and CHEMICALS.
120 and 121, NEWGATE STREET, LONDON, E.C.

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

CANNEL, COAL, ETC.
JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, SCOTLAND.

WANTED, an experienced Foreman RETORT-SETTER for large Gas-Works in Yorkshire. Regular employment for suitable Man.
Apply, by letter, to No. 3368, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Representative, who must be a fair DRAUGHTSMAN, and capable of taking accurate Particulars of Contracts.
State Age, full Particulars of Experience, and Salary required, to the LEEDS FIRE-CLAY COMPANY, LIMITED, Engineering Department, Wortley, near LEEDS.

WANTED, by a Firm of Contractors in Liverpool, an INSPECTOR thoroughly conversant with the Deacon Meter System.
Reply, stating Age, Experience, present Position, Wages required, and all other Particulars, to M. 22, care of C. Birchall, Advertisement Contractor, LIVERPOOL.

STOKER wanted for small Gas-Works.
Wages 24s. per week in Winter; 22s. per week in Summer. Very comfortable and easy place to an industrious and steady Man.
Apply, stating full Particulars, to the MANAGER, Gas-Works, Knowle, near BIRMINGHAM.

ULVERSTON GAS AND WATER-WORKS.

FOREMAN.

WANTED, at once, a thoroughly experienced, steady, and reliable Man to act as FOREMAN of these Works (both inside and outside).

None need apply except those whose character will bear the strictest investigation, and who have occupied a similar position before.

Wages 36s. per week.

Applications, with References, to be sent to the undersigned.

JNO. SWAN,
Engineer and Manager.

Nov. 4, 1899.

FENTON URBAN DISTRICT COUNCIL.

GAS MANAGER.

THE Gas Committee require the services of a thoroughly competent GAS MANAGER, at a Salary of £200 per annum, to take charge of their Gas-Works (80 million cubic feet made per annum).

Applications, in Candidates' own Handwriting, with full Particulars as to Age, Training, and Experience, accompanied by not less than three *copy* Testimonials of recent date, to be sent to me (marked "Gas Manager"), not later than Saturday, the 11th prox.

Canvassing, either directly or indirectly, will disqualify.

By order,
CHAS. ADDERLEY,
Clerk.

Town Hall, Fenton, Staffs.,
Oct. 27, 1899.

COUNTY BOROUGH OF BLACKBURN.

ASSISTANT GAS ENGINEER.

THE Gas Committee of the Corporation of Blackburn are prepared to receive APPLICATIONS for the position of ASSISTANT GAS ENGINEER.

Any Person applying will be required to have had a thorough training in Gas Manufacture, Purification, and Distribution, together with a Practical knowledge of Sulphate Making. He must also be able to prepare Plans and Specifications for any intended New Works.

Applicants must be over 25 Years and not over 30 Years of Age.

Salary to commence at £150 per annum, and to increase by five annual Increments to £200 per annum.

Applications, enclosing not more than Three recent Testimonials, to be sent, addressed to the Chairman, properly endorsed "Assistant" not later than Saturday, Nov. 11, 1899.

Canvassing any Member of the Council will be considered a disqualification.

By order,
S. R. OGDEN,
Gas Engineer.

Gas-Works, Blackburn,
Oct. 18, 1899.

WORKING Foreman or Leading Stoker, wanted at once, by a Gas Company on the Coast in the West of England. Must be thoroughly competent to take charge of the Retort-House, Boiler, Exhausters, and Works generally. One accustomed to Shovel Charging and Regenerative Furnaces preferred. None but fully qualified, steady, and reliable men need apply. Alternate weeks, Night and Day Shifts. Wages from 27*s.* to 30*s.* per week.
Apply, by letter, to No. 3374, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a small second-hand Gas-HOLDER, about 1000 cubic feet capacity.
Apply, with full Particulars, to J. GRIFFIN, Manager, Fareham Gas and Coke Company, Fareham, HANTS.

IRON ROOF for Sale, 132 feet long by 53 ft. 4 in. Span, in first-class condition.
Apply to CLAYTON, SON, AND CO., LIMITED, Hunslet, LEEDS.

ENGINE and Exhausters, 20,000 and 30,000 cubic feet per hour, delivered immediately. Cheap to clear.
J. F. BLAKELEY, Thornhill, DEWSBURY.

CAST Tank, 31 feet diameter, 12 feet deep, £4 15*s.* per ton. Straps and Bolts included. Five Years old.
J. F. BLAKELEY, Thornhill, DEWSBURY.

FOR SALE—A small Sulphate of AMMONIA PLANT, practically new, made by Goddard, Massey, and Warner, Limited, Nottingham.
Apply to ROBERT COCHRANE, 17, Water Street, LIVERPOOL.

FOR SALE—Gas-Making Plant, complete, and in good working order. Suitable for Country Mansion, or small Village.
Capacity and all Particulars on application to ESTATE OFFICE, Wadhurst Park, Wadhurst, SUSSEX.

FOR SALE, owing to Extensions—
A SINGLE-LIFT GASHOLDER, with Cast-Iron Tank, 37 ft. 6 in. diameter and 12 ft. deep.
A LIVESEY WASHER, capacity 100,000 cubic feet per day, with 8-inch Inlet, Outlet, and Bye-Pass Valves and Connections.
All in perfect condition.
For further Particulars, apply, by letter, to No. 3373, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ALDERSHOT GAS AND WATER COMPANY.

TAR.

THE Directors of the Aldershot Gas and Water Company are prepared to receive TENDERS for the purchase of the surplus TAR to be produced at their Gas-Works, Aldershot and Farnborough, for Twelve Months ending Dec. 31, 1900.
Particulars may be obtained from the undersigned.
Sealed and endorsed Tenders to be forwarded on or before Thursday, Nov. 30, 1899, endorsed "Tender for Tar."

By order,
REGINALD W. EDWARDS.
Secretary.

Oct. 27, 1899.

LEIGH URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the supply of 90 Tons of NATURAL BOG ORE PURIFYING MATERIAL, and for the purchase of about 250 Tons of SPENT OXIDE OF IRON.
Forms of Tender and further Particulars may be obtained from the Manager, Mr. John Foster, Gas-Works, Leigh, Lancs.
Sealed Tenders, endorsed "New Oxide" or "Spent Oxide" (as the case may be), and addressed to me, the undersigned, to be delivered at the Town Hall, Leigh, Lancs., on or before Tuesday, the 14th day of November, 1899.

PEREGRINE THOMAS,
Clerk and Solicitor.

Town Hall, Leigh, Lancs.,
Oct. 26, 1899.

EDINBURGH AND LEITH CORPORATION'S GAS COMMISSIONERS.

CONTRACTORS' PLANT.

THE Gas Commissioners are prepared to receive TENDERS for the supply of the following PLANT and APPLIANCES, delivered at the Gas-Works Site, Granton, Caledonian Railway, North British Railway, or *ex* Ship, Granton Harbour:—
Four-Wheeled LOCOMOTIVE TANK ENGINE, 12-inch Cylinders, 18-inch Stroke, Wheel Base 5 ft. 6 in., Gauge of Railway 4 ft. 8½ in.
5-Ton LOCOMOTIVE STEAM-CRANE (4 ft. 8½ in. Gauge).
7-Ton STEAM-DERRICK CRANE, with Boiler.
10-Horse Power Double Cylinder PORTABLE ENGINE and BOILER.
Two NAVVY GRABS of 1 Cubic Yard capacity.
Two TURNOVER SKIPS.
Two DROP BOTTOM SKIPS.
600 Lineal Yards of LIGHT RAILWAY, 24-inch Gauge, composed of 20 lbs. Steel Rails riveted to Steel Sleepers, complete with Points, Crossings, &c.
Twelve Steel SIDE TIPPING WAGGONS, capacity varying from one to three Cubic Yards.
Tenders are to be addressed to the undersigned, and delivered at 25, Waterloo Place, on or before Ten a.m. on the 20th day of November, 1899.
The Commissioners do not bind themselves to accept the lowest or any offer, and reserve to themselves the right of accepting the whole or any portion of the Appliances tendered for.

JAMES MC G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
Nov. 1, 1899.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

BOROUGH OF BURTON-UPON-TRENT.

FIRE-CLAY GOODS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS for the supply of the FIRE-CLAY RETORTS, BRICKS, and CLAY required at the Gas-Works during the Year 1900.
Full Particulars of the Specification and Conditions, with Form of Tender, may be obtained on application to the undersigned, to whom sealed Tenders, endorsed "Fire-Clay Goods," must be delivered on or before Thursday, the 23rd day of November inst.
The lowest or any Tender will not necessarily be accepted.

F. L. RAMSDEN,
Manager and Engineer.

Gas and Electric Light Works,
Burton-upon-Trent, Nov. 1, 1899.

ORIENTAL GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices of the Company, Finsbury House, Blomfield Street, London, E.C., on Wednesday, the 15th day of November, 1899, at Twelve o'clock noon precisely.
The Directors who retire are Messieurs R. Hesketh Jones and Robert Miller. The Auditors, Messieurs S. W. Savage and W. Williams, also retire. All are eligible for re-election, and offer themselves accordingly.

By order of the Board,
H. J. LUFF,
Secretary.

Finsbury House, Blomfield Street,
London, E.C., Nov. 1, 1899.

N.B.—The Transfer Books will be closed from the 13th of November to the 2nd of December, both inclusive.

ISSUE OF SIX PER CENT. PREFERENCE SHARES.

BOURNEMOUTH GAS AND WATER COMPANY.

Sale by Tender of 1000 6 PER CENT. PREFERENCE SHARES, in pursuance of the Provisions of the Bournemouth Gas and Water Act, 1896.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER 1000 PREFERENCE SHARES of £10 each (the Dividend on which is limited to 6 per cent.), to be paid up in full on or before the 28th of February, 1900.
Particulars and Conditions of Tender may be obtained at the Company's Offices, Bournemouth; or of the Secretary, as under.
Sealed Tenders must be sent to the Secretary not later than Eleven o'clock on Friday morning, the 24th of November, 1899.

By order,
WILLIAM CASH,
Secretary.

London: 90, Cannon Street, E.C.

SCARBOROUGH GAS COMPANY.

SALE BY TENDER OF NEW ORDINARY STOCK,
IN PURSUANCE OF THE SCARBOROUGH GAS ACT, 1895.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER NEW ORDINARY STOCK of the Company, to the amount of £12,000, such Stock to bear a Maximum Dividend of 5 per cent. per annum, and to be paid up in full on or before the 1st day of January, 1900; being a portion of the Additional Capital authorized to be raised under the powers of the above-named Act, by a Resolution passed at a Meeting of the Proprietors of the Company specially convened for the purpose, and held on the 26th day of June, 1895.
Particulars and Conditions of Tender may be obtained on application at this Office; and sealed Tenders must be sent in not later than Twelve o'clock at noon, on the 1st day of December, 1899.

By order,
J. HOLLIDAY,
Secretary.

Scarborough Gas Company's Offices,
32, Westborough, Scarborough,
Nov. 1, 1899.

SOUTHAMPTON GASLIGHT AND COKE COMPANY.

ISSUE OF £10,000 5 PER CENT. ORDINARY STOCK.

SALE BY TENDER.
MINIMUM PRICE £117 PER CENT.
INVESTMENT AT THIS PRICE WOULD YIELD 4¼ PER CENT.

REGISTERED FREE OF ALL EXPENSES.

THE Directors invite Tenders for £10,000 of ORDINARY STOCK, authorized to be raised under the Southampton Gas Act, 1898, entitled to a Maximum Dividend at the rate of Five Pounds per cent. per annum, payable Half-Yearly (subject to Income-Tax).
Allotments to the highest bidders.
Tenders must be delivered on or before Wednesday, the 15th of November, 1899, by Ten a.m.
Forms of Tender, with Particulars and Conditions, may be obtained on application to the Secretary, at the Company's Offices, Ogle Road, Southampton, or from the Company's Bankers, Grant and Maddison's Union Banking Company, Limited, Southampton; or from Lloyd's Bank, Limited, Lombard Street, London.

By order of the Directors,
C. CROWTHER SMITH,
Secretary.

Southampton, Nov. 1, 1899.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by AUCTION of GAS AND WATER STOCKS and SHARES under Parliamentary Powers.
He also Holds MONTHLY SALES of GAS and WATER STOCKS and SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the Issuing of Capital, and also for offering to Auction Gas and Water Stocks and Shares, and all Particulars relating thereto, may be had of Mr. ALFRED RICHARDS.
Offices: 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

BARNET DISTRICT GAS AND WATER COMPANY.

NEW ISSUE OF £5300 "D" GAS STOCK.
Ranking for a Maximum Dividend of 7 per cent.; the last Dividend on similar Stock in the Company having been £6 6*s.* per Cent. per annum.
TO BE SOLD BY AUCTION BY
MR. ALFRED RICHARDS, at the Mart, E.C., on Wednesday, Nov. 29, at Two o'clock.
Particulars of the AUCTIONEER, as above.

By order of the Directors of the

SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 600 £10 ADDITIONAL ORDINARY SHARES.
MAXIMUM DIVIDEND 7 PER CENT.; LAST DIVIDEND 5½ PER CENT.
MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, the 29th of November, at Two o'clock.
Particulars of the AUCTIONEER as above.

By order of the Directors of the

HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF 259 £10 "C" SHARES.
STANDARD DIVIDEND 7 PER CENT.; LAST DIVIDEND £5 12*s.* PER CENT.
MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Wednesday, the 29th of November, at Two o'clock.
Particulars of the AUCTIONEER, as above.

By order of the Directors of the

COMMERCIAL GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 5, at Two o'clock precisely, in Lots,
£3037 OF NEW STOCK,
Ranking for a Standard Dividend of 7 per cent., subject to the Sliding-Scale; the last Dividend on the Company's New Stock having been at the rate of 10½ per cent. per annum. Also
£3167 OF FOUR-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK OF THE COMMERCIAL GAS COMPANY.
Particulars of the SECRETARY OF THE COMPANY at their Offices, Ben Jonson Road, STEPNEY, E.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of Trustees.

SOUTH ESSEX WATER-WORKS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 5, at Two o'clock, in Lots.
£900 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
£625 FIVE PER CENT. PREFERENCE STOCK, & £1085 ORDINARY STOCK
OF THE
SOUTH ESSEX WATER-WORKS COMPANY.
Particulars of the AUCTIONEER as above.

Now Ready, Price 15*s.*, *Limp Cloth*,

— NINETEENTH YEAR —

AN

ANALYSIS OF THE ACCOUNTS

OF THE

METROPOLITAN WATER COMPANIES

(Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex)

AND OF THE

CORPORATION WATER UNDERTAKINGS

OF

EDINBURGH, GLASGOW, & MANCHESTER,

FOR THE YEAR 1898-1899.

Compiled and arranged by

LASS, WOOD, & DREW,

Chartered Accountants.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

Now Ready, 120 *Pages, Demy* 8vo., *Bound in Stiff Cloth Cover, Lettered, Price* 5*s. Post Free,*

THE

VALUATION OF GAS, ELECTRICITY, AND WATER WORKS

FOR

ASSESSMENT PURPOSES

SECOND EDITION

By THOMAS NEWBIGGING, M.Inst.C.E., & WILLIAM NEWBIGGING, Assoc.M.Inst.C.E.

WITH AN APPENDIX OF DECIDED CASES.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

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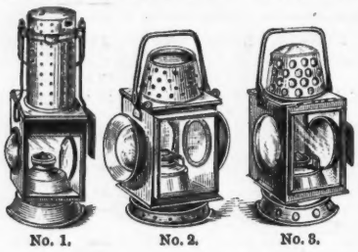
CANDLE SAFETY LAMPS.



No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

LONDONDERRY GAS COALS
FROM THE
LONDONDERRY COLLIERIES,
COUNTY OF DURHAM.

Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal,
as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR,
COUNTY OF DURHAM.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

NITRATE of Thorium and Cerium.
FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND CO., HAMBURG.

GAS-FITTINGS.

BURNERS
Welsbach Pattern
per 7/6 Doz.
WRITE FOR CATALOGUE.
WHOLESALE
FITTINGS COMPANY
80, Commercial Road,
London, E.

INCANDESCENT

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton	11,205 Cubic Feet.
Illuminating Power	16$\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality)	13$\frac{3}{4}$ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

WELDON MUD
FOR
GAS PURIFICATION.
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED, —
1, FENCHURCH AVENUE, LONDON, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
CANNEL & COAL.

TYNE
BOGHEAD
CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP
GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN
GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works
(also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON, NEWCASTLE."

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
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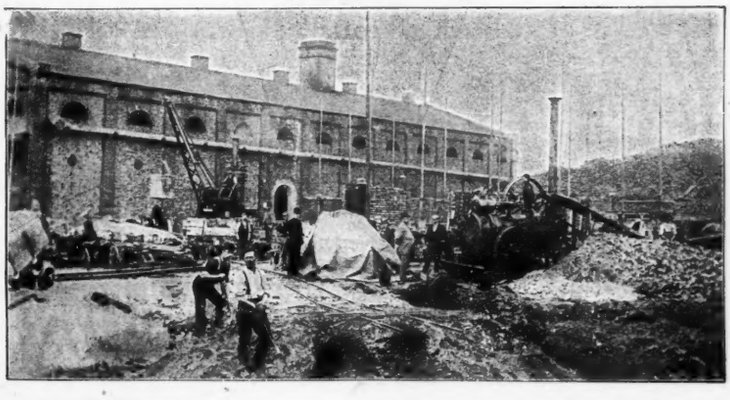

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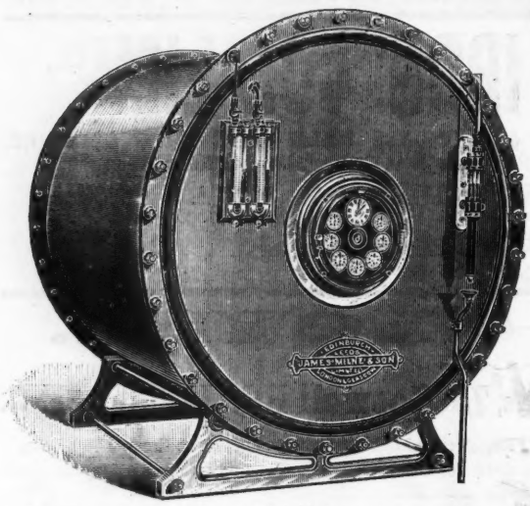

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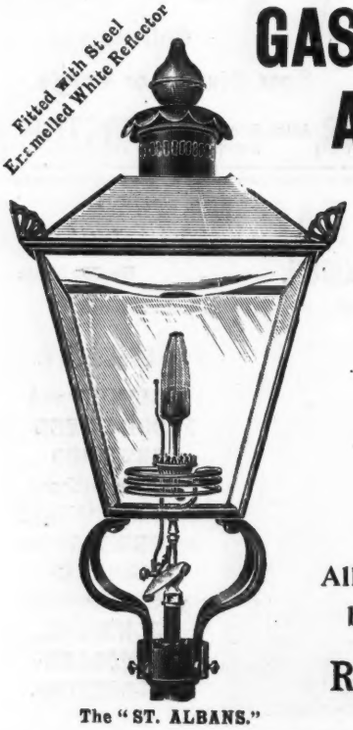

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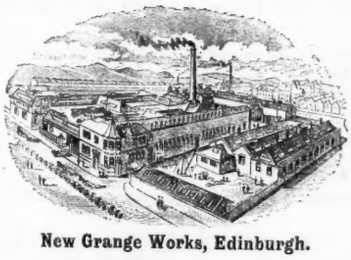

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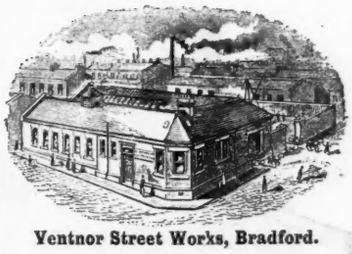

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TESTIMONIAL

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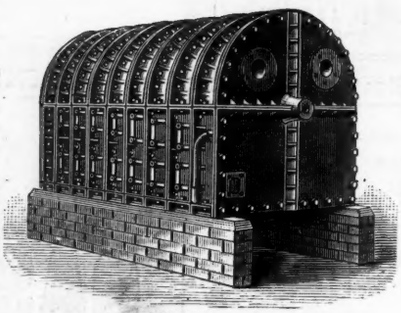
Gas-Works, Buckland,
Dover, Feb. 8, 1899.

H. KIRKHAM, Esq.

Dear Sir,—Have now made further tests with the Washer fitted with your PATENT WASHING DEVICES, and have much pleasure in reporting that *the results were highly satisfactory*; also, I ascertained that the maximum results were obtained when the machine was working at three revolutions per minute. At this speed 13 to 14 gal'ons of water per ton of coal carbonized were converted into 10-oz. Ammoniacal Liquor, and at same time the Gas was free from Ammonia.

Should you wish further details, I will forward them.

I am, dear Sir, yours truly,
RAPHAEL HERRING, Engineer.



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The Scrubbing Devices are metal scrolls fixed in cages of segmental form, which can be readily and successively removed from the wheels through a manhole on the top or side of the machine, and the enclosed Scrubbing Devices taken out, cleaned, and replaced without the delay that necessarily takes place when the entire scrubbing material of the whole wheel has to be dealt with in one operation—thus effecting an important saving in time and labour. These Cages can be applied to the wheels of any machines of the type shown, and will increase their efficiency above 20 per cent.

The Scrubbing Devices are unequalled for extracting the whole of the Ammonia and a very large proportion of the Carbonic Acid and Sulphuretted Hydrogen from the Gas; and, if required, the strength of the Ammoniacal Liquor can be worked up to 30 oz. and above, which greatly reduces the quantity of Oxide or Lime, and also the amount of Labour for Purification.

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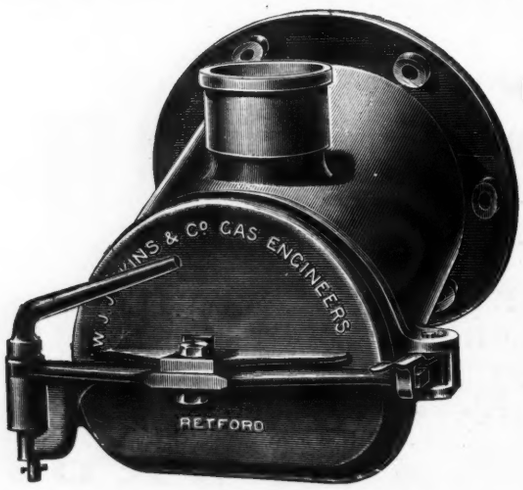

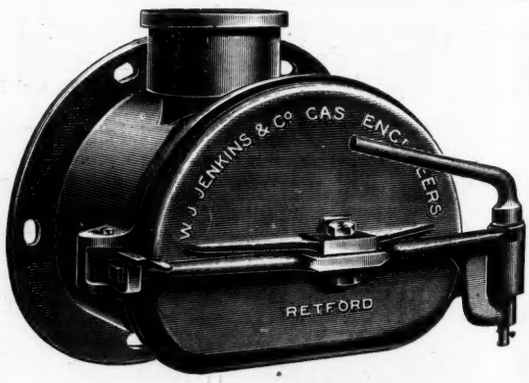

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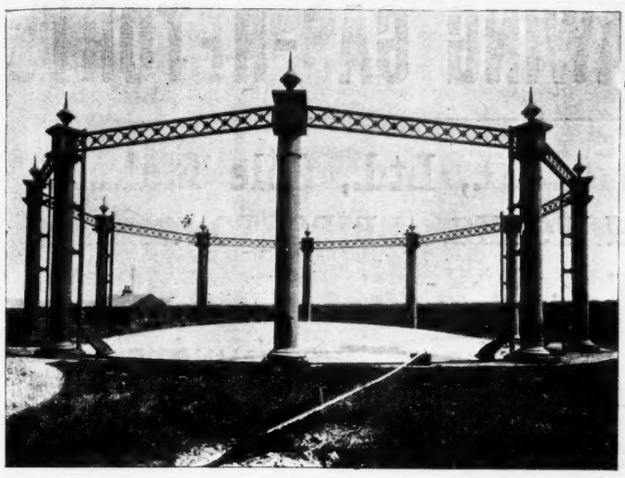
GASHOLDERS



A GASHOLDER

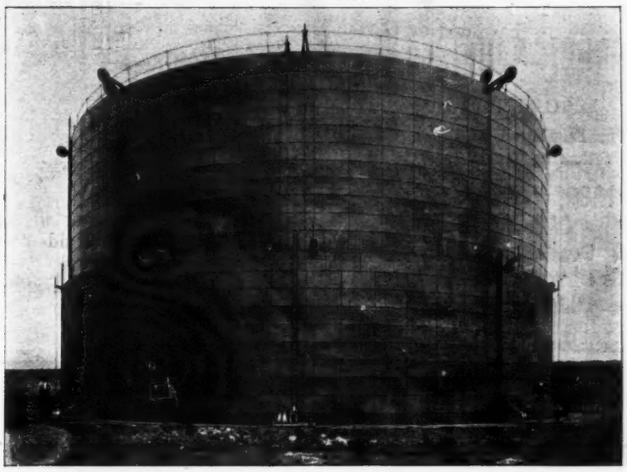
Guided by Ten massive Cast-Iron Columns and Girders is shown in the accompanying Photo.

AS IT WAS

originally erected by us

IN 1883.

We have this year taken down the Guide Framing, converted the Holder into a Two-Lift; and this Photo. ☛ shows it



AS IT IS NOW

entirely guided by our Patent Steel Cable System.

In many other instances, Columns have been sold and replaced by our Cables.

We are prepared to alter any Holders in a similar manner to the above. Engineers who have trouble with the irregular working of Column-Guided Holders will find the Cable System vastly superior and quite reliable.

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FOR
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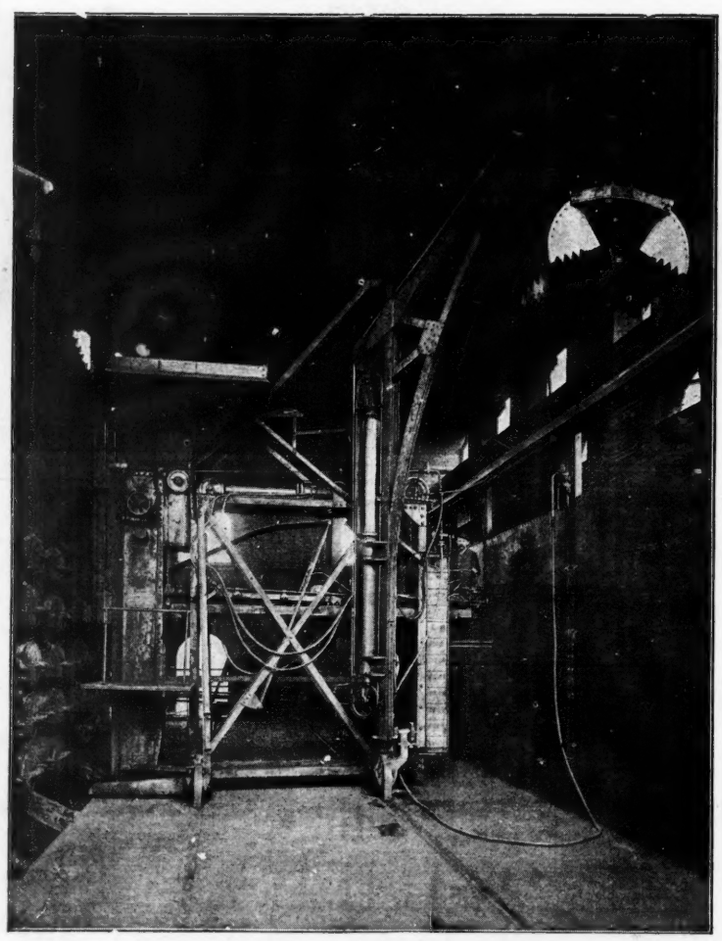

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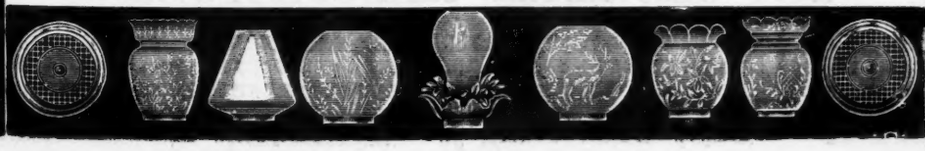

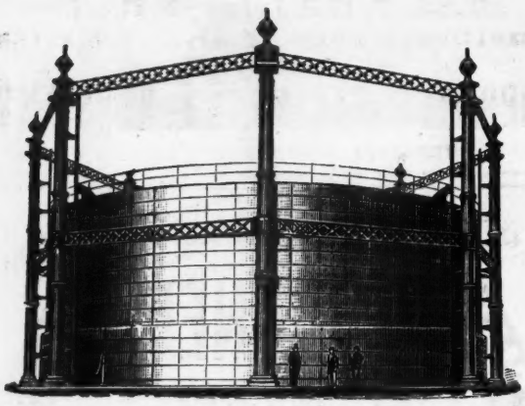

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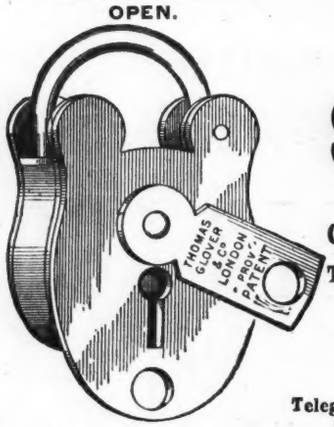

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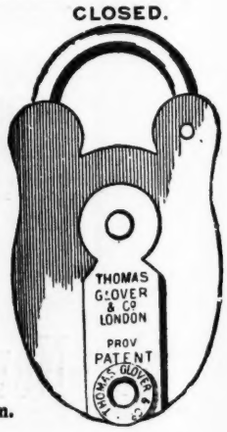

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UNSURPASSED FOR QUALITY AND VALUE.

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12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
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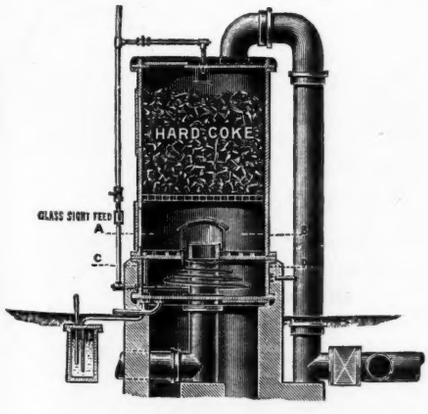

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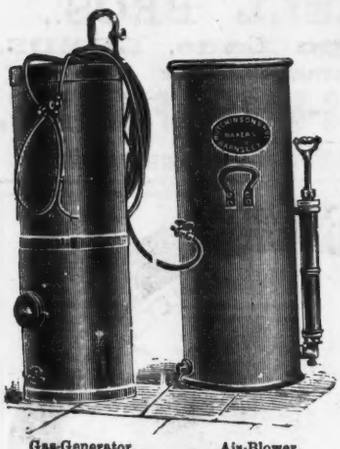

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LEAD WORK FOR SULPHATE OF AMMONIA PLANTS.

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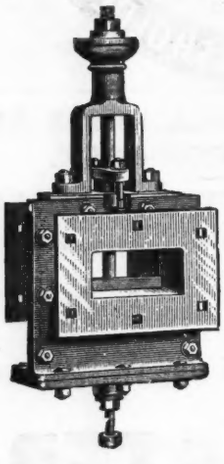

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